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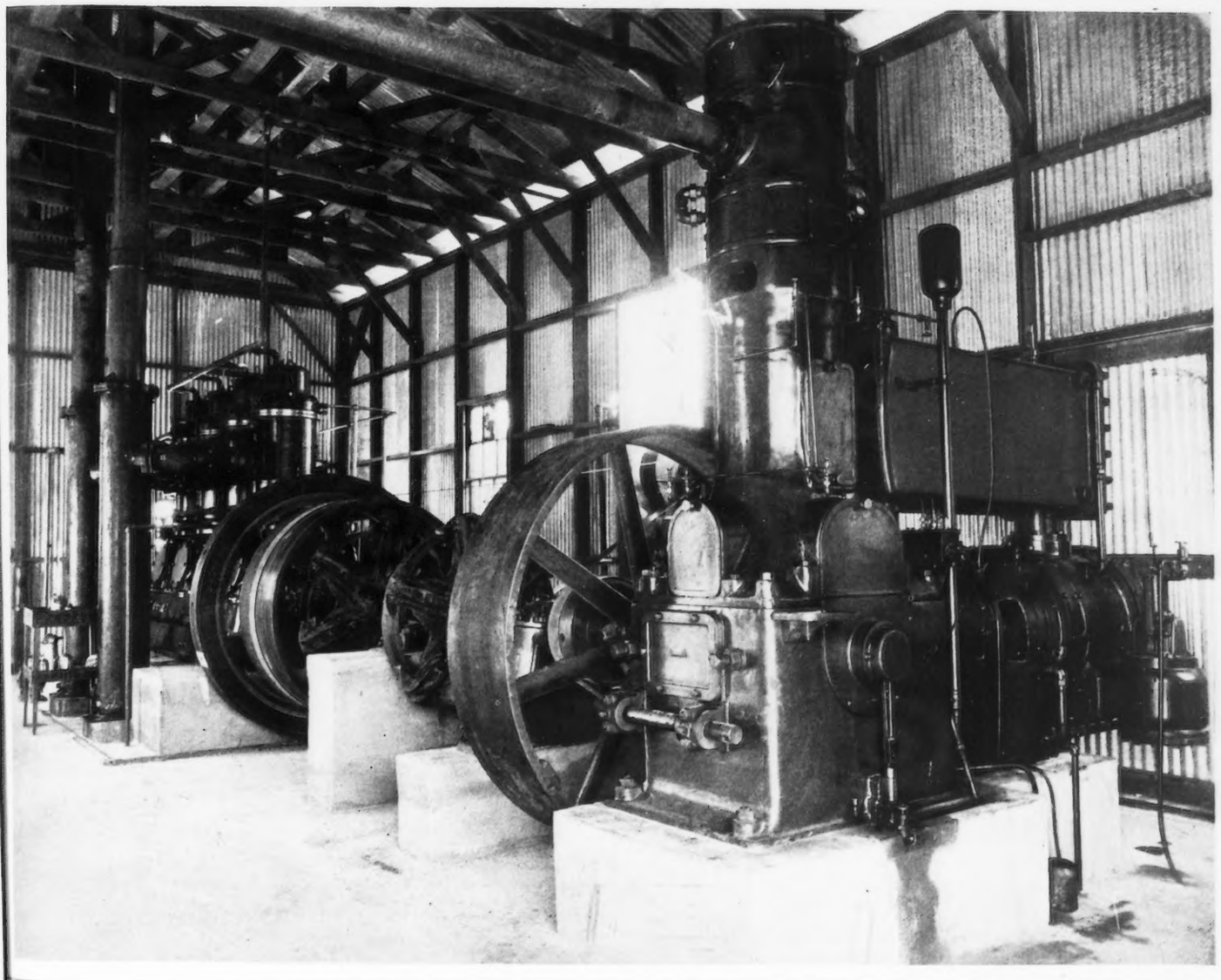
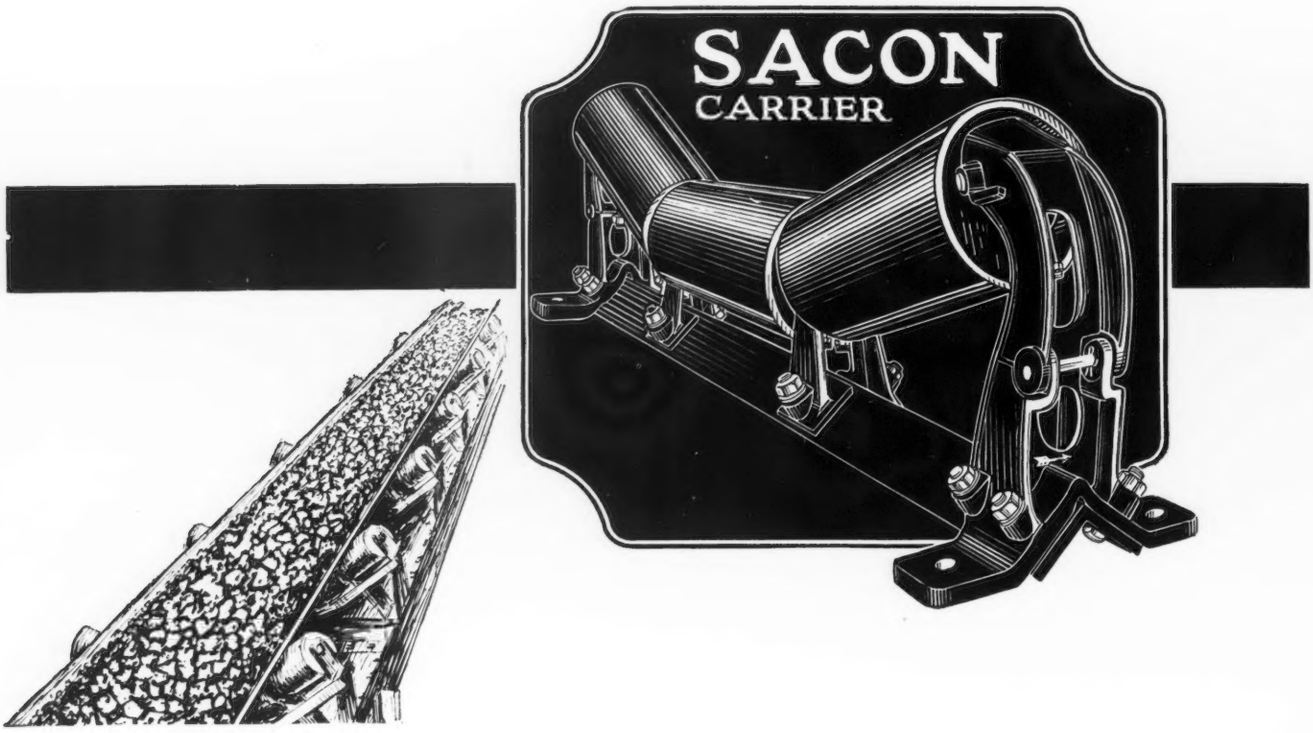


A 200-hp. Diesel engine direct-connected to a 1,015-cu. ft. angle-compound air compressor at the plant of the Pierson Mine Co., near Independence, California, in the Inyo Range

Apparatus for Studying Gases of Explosives Detonated Under Confinement, by J. E. Crawshaw and G. W. Jones—Mines and Minerals of Inyo County, California, by George J. Young—Genesis of Sulphide Ores, by Horace Freeman, and Alkaline Sulphides as Collectors of Metals, by E. Spurr—Annual Meeting of American Mining Congress at Washington, D.C. Biography of James Latimer Bruce



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ENGINEERING AND
MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

Volume 120 | New York, December 19, 1925 | *Number* 25

Coal and Other Strikes

IN THE WORLD'S most advanced countries the question of capital versus labor bids fair to become an archaic one in time, or at least an academic one. The capitalism which succeeded feudalism—the economic tyranny which succeeded the tyranny of arms—created wilfully a starkly opposed class—the labor which performed the function of hands to the head and the pulse of capital. In this functioning entity of a body the hands and the head were contrary and mutually and rightfully distrustful. The earliest stage was where the employer deemed it advisable or even economically imperative to keep the employee in complete subordination, not to say servitude. The pre-revolution condition of the Mexican laborer is an example of what existed in many an industrial center of England and even America at an earlier date. Revolt and social revolution under such conditions became necessary and acceptable; and the development of unionism and the increase in power of organized labor. With the swing of the pendulum it became and always becomes inevitable that organized man-power secures the upper hand, and misled by theories as erroneous as those which earlier activated their employers, proceeds in their turn to believe that they can absorb all the rewards of industry; and that capital can be left with a pittance or nothing, or even abolished. Post-revolution Russia is an example of such a counter-experiment. The strike weapon becomes an effective and inevitable one when the struggle for overbearing domination by one or the other group is going on. The third and last stage is when each group has learned to know better and respect more the other —to realize the worth and necessity of the other, and to accept a mutually beneficial partnership.

In the United States labor-capital troubles have entered upon the third stage. Mr. S. D. Warriner, representing the anthracite operators, in his speech in Washington at the American Mining Congress meeting, quoted with approval the recent statement of Mr. William F. Green that labor had passed the militant stage and reached the co-operative stage. While that is true of America in general and the American Federation of Labor, it is not yet true of the coal industry and United Mine Workers. This dispute is simply a survival of a condition that was representative of the whole country a quarter of a century ago—a residual, a monadnock. Labor-capital troubles in the coal industry represent a milestone which was passed by the metal-mining industries twenty years ago. It will be passed in the coal industry when each side learns to look after the other as well as itself. To blame the situation on any one side is superfluous discussion. Public opinion is the test which will settle the strike in the long run. Public opinion at the moment inclines to be indifferent, realizing that though the mine workers at the present instant are unreasonable in their demands and careless in their methods, yet the mine operators in the past have been guilty of indifference and carelessness. For a permanent peace, each side will soften its asperities and cement a new and closer economic partnership, in which the public will demand a third interest, on penalty of switching its trade elsewhere.

Financing the Consumer

IN THE LAST FEW YEARS an important change has been made in the United States in the marketing of non-perishable commodities to the ultimate consumer. Automobiles, phonographs, radio sets, pianos, books, washing and ironing machines and vacuum sweepers, and a rapidly growing list of other commodities are now sold almost entirely on the instalment or chattel mortgage plan, the cash payment being only a small fraction of the ultimate cost. The balance is paid "like rent," or "out of savings" secured by the use of the utility in question. Automobile marketing is the most important of the businesses so conducted, giant financing organizations having been organized for this very purpose. The plan has not yet proceeded far into foreign fields, though the U. S. Department of Commerce is now working on it, as an aid to the export businesss of automobile manufacturers.

The idea has several excellent features that are fairly obvious. From the manufacturer's standpoint, it is a great aid to sales. Also, the buyer may be thus permitted to produce or live more economically, through having the use of the partly-paid-for machine, and through the necessity of curtailing other expenditures and working hard to meet the monthly payments. On the other hand, the plan involves a tendency to inflation, and in a period of declining business activity it remains to be seen how many buyers will have trouble in meeting their commitments.

So far as known, manufacturers of mining machinery have not yet adopted the system. If an operator needs a new ball mill he must wait until he can pay for it out of accumulated earnings, rather than out of expected savings brought about by its use. And yet, this system of selling is progressing so fast that all manufacturers of commodities that sell for more than a few dollars should consider its application to their business. The manufacturer who is the first to work out a plan for extended payments will have an important advantage over his competitors.

Mining Versus Real Estate

MANY AN OPPORTUNITY along the wayside is passed unnoticed by those en route to Florida to bet their money before the real estate game plays out. Stretching south through Georgia, along the Dixie Highway and other routes, are numerous mining enterprises, chiefly non-metallic and of modest scope, that could stand an additional bit of capital. Some of these ventures might yield a respectable profit on a

comparatively small investment. Even those with the more dubious chances would be smaller risks than contracting to buy undeveloped land at highly inflated prices in the hope of turning it over before taking title.

At present, Georgia is producing a wide diversity of minerals in commercial quantities. At Cartersville, in Bartow County, are the largest ocher and barytes properties in the United States and various others of smaller size, some partly developed and crudely worked. Bauxite, the principal ore of aluminum, and kaolin, fuller's earth, and other clays are found in numerous places, some of the deposits being of much importance. Asbestos, chlorite, chromite, corundum, feldspar, fluorspar, talc, and mica invite the attention of the man with money. Marbles, limestones, granites, and other building stones and road materials yield a large production annually and offer further opportunities to the capitalist. Iron ore, manganese, gold and coal are also included among the state's resources.

As in Georgia, so also in Alabama and other southern states. In Florida itself, though the phosphate there is closely held, other minerals merit notice. One thing the prospective investor or speculator might bear in mind: though a prospect prove worthless as a mine, it is still a piece of real estate and possibly as valuable and useful as many a Florida tract.

Deep Mining in Michigan

DEEP MINING has come to stay. The Calumet & Hecla Consolidated Mining Co. has made a bold step forward, and is now developing a mine within and beneath a mine. On the 81st level a complete hoisting, haulage, and pumping plant is being installed, which, in relation to the ore deposit, is the surface plant as much as is the equipment of the Tamarack or Red Jacket shaft for the original outcrops. The principle is not new, for winzes have been and are being equipped with small hoists to deliver ore and rock to an underground haulage system for hoisting through the main shaft. The St. John del Rey mine, in Brazil, is likewise operating with a number of subterranean hoists, the lowest one hoisting from a vertical depth of 6,400 ft. below the surface to an intermediate level. The mines of the Coeur d'Alene have long been equipped with underground hoists, but on adit levels. In the case of the Michigan copper mines, the depth for economic and practical hoisting on the 8,100-ft. slope had about been reached. Good ore has been found at a distance from the Red Jacket shaft, which will continue to be the main outlet for ore. The present plans are for sufficient equipment to extend the mine workings 3,000 ft. or more below the 81st level, and transfer the ore from the underground shaft through an 8,000-ft. haulageway, to one or the other of two shafts that collar at the surface.

The great venture has been made possible only by the use of electricity, electric hoists, electric pumps, and electric haulage. Ventilation will, of course, be a problem, but not so much as one would at first imagine when measured in terms of coal mining. The mines contain no gas, and the open spaces are comparatively small; there are practically no sulphide ores (the copper being almost entirely in native form), and for that reason there will be but little heat from oxidation. The main requirements, therefore, will be to supply air, to replace that vitiated by the use of explosives and by the workmen, and to reduce temperatures to offset their augmentation with depth. This latter, however, is not a serious question with the Lake Superior copper mines. The temperature of the rock at a depth of 4,580 ft. is about 72 deg. F. The rock temperature at Butte on the 3,000-ft. level is approximately 94 deg., while on the 3,700-ft. level rock temperatures as high as 104 deg. have been measured. The rock temperature of the St. John del Rey mine, in Brazil, at a depth of 6,400 ft. varies from 102 to 110 deg. F. and by proper ventilation the air currents in the mine workings are kept at a temperature of 8 to 10 deg. below the rock temperatures.

The installation of this plant insures a life of many years for this famous copper-producing district. It is estimated that there is sufficient ore above the 81st level to last ten to fifteen years, while the lower limits of the orebody have not yet been defined. Will not this underground mining plant be a forerunner of additional plants of similar character to utilize electrical equipment at still greater depths? It would seem that with the application of electric power the depth to which mining can be carried on will be determined almost entirely by the temperature of the rock within the mine.

Resumption of Hydraulic Mining in California

FOR NO LITTLE TIME there has been discussion of the feasibility of rejuvenating hydraulic mining in California. Hydraulic mining as an important mining industry has been dormant for many years; nevertheless, some of it has continued, and the roar of the "giants," although subdued and only in a few places, has continued. What is hoped for is a more or less general resumption. The California Débris Commission and a few of the experienced miners are interested, and investigation of débris-dam sites is being made, as well as of the possibilities of securing co-operative action of power companies, irrigationists, and the government in financing the construction of dams for the triple purposes of power, water, and débris storage.

Resumption on an important scale is to be desired, but many vital questions must be definitely answered by engineering investigations before the profitableness of hydraulic mining operations can be visualized. A casual inquiry will show that little fundamental information is available at present. The average value of available deposits is in most instances only vaguely known. While there is available the partial history of past efforts, it must be noted that the present-day conditions are fundamentally different. Private and public interests have grown immensely. Water rights have increased and are extremely complex. Labor wages and the cost of supplies have advanced several times over what they were in the days of the hydraulic miner. Is it possible under present conditions to mine gravel containing from 8 to 12c. per cubic yard which was under old conditions a moderately profitable operation? Costs were then around 6c. per cubic yard and labor was paid about $2.50 per day. Water was to be obtained for the cost of diverting dams and ditches, and once these were constructed the principal costs were those necessary for maintenance. Under modern conditions, the hydraulic miner would have either to purchase his water or to construct flood storage reservoirs and the necessary ditches and pipe lines. Furthermore, he would be subjected to a "tax" for débris storage upon every cubic yard mined. It is improbable that a hydraulic mining enterprise could stand on its own bottom unless governmental assistance was given for the construction of storage dams. Granted that this

assistance was given, the economic outcome, upon the basis of 12c. per cubic yard, would be dubious.

It would be necessary to improve hydraulic mining practice in some fundamental way that would result in lower costs than those obtaining under the old conditions. This could perhaps be accomplished by using the water under much greater pressures and thereby obtaining a higher efficiency. A redesign of the mining equipment would be necessary. Thus we feel safe in saying that in order to consider the feasibility of resuming hydraulic mining it will be necessary first to devise and to use sampling methods that will enable the value of the deposits to be accurately estimated, and, second, to improve the mining equipment and methods so that operating costs can be sufficiently lowered to absorb part of the cost of débris storage. Necessarily this involves an experimental period during which these factors can be tried out and experience gained with them. Without this preliminary experience it would be impossible to predict the financial outcome to be expected from a hydraulic mining enterprise in California. With experience under present-day conditions there is reason to hope that some of the deposits now upon the watershed of the Yuba might be profitably worked.

Mountains and Mines

THE IDEA OF MINES is usually associated with mountainous and remote places. This is due in large measure to the great mineral zone which follows the Cordilleran belt of North and South America, and indeed reappears in Japan, and to a large extent girdles the Pacific. Vulcanism (by which is meant the movement of magmas laterally and upward), the injection of metallic ores, and the upbending and breaking of rocks, constitute three sets of phenomena closely associated and gradually allied: hence it is true that mines and mountains are associated, in fact as well as in the mind's eye. But this will not hold for those mountains which have been worn down to their roots, exposing the orebodies originally introduced there; for in such cases ore and nearly level topography are associated, as in the mineral regions of eastern Canada. Again, there are regions where ore deposits occupy a relatively flat and fertile country, with nearly horizontal strata, as in the lead and zinc regions of Missouri and near-by states. Here there has been little bending and breaking of the rocks, though there has been some: also, not much magma movement and injection, although again there are some traces of it.

In mountainous regions the characteristic topography of a vein or mineralized reef depends upon its hardness. A hard quartz outcrop frequently is left in bold relief on some hilltop, being harder than the inclosing rocks: while a mineralized shear zone may be softer than the inclosing rocks, and be worn into a groove or depression of greater or less accentuation.

Professor S. J. Schofield, in a paper before the Canadian Institute of Mining and Metallurgy, last February gave the opinion that, in British Columbia, prospecting the valleys would be likely to have greater success than in the mountains. The vein systems of British Columbia, he pointed out, fall into two definite groups, one with northwesterly trend, the other northeasterly. The northwesterly series is chiefly characterized by copper, the northeasterly by gold or silver-lead. Moreover, the copper deposits are mainly along shear zones, while the gold and silver-lead ore are characteristically fissure veins. He points out that the fiords of British Columbia fall directionally into the same two systems as the mineral veins; and concludes therefrom that shear-zone ore deposits are best prospected for in the inland valleys, which are the continuation of the fiords, and in other depressions of the same set. Recognizing the difficulties of valley prospecting, on account of the overburden, he sees the remedy in the application of electrical prospecting devices.

Idaho Copper Wash Sales

THE Idaho Copper Corporation, concerning which the State Mine Inspector of Idaho has issued warnings to investors, alleging misleading literature issued for stock-selling purposes, while the company had nothing but an undeveloped prospect, receives one more ray of additional light—among a profusion of rays—from the court investigations in New York of the business methods of a brokerage firm recently expelled from the Consolidated Stock Exchange. At this court inquiry a member of the Consolidated Exchange testified, as reported in the press, that he conducted "wash sales" in Idaho Copper for George Graham Rice, promoter.

"The name of George Graham Rice, whose activities have been under official scrutiny from time to time, cropped up during the testimony of Lester W. Birdsall, a member of the Consolidated, who said he carried an account in Idaho Copper shares for Rice under the accounts of 'Wall Street Iconoclast' and 'No. 11.' Martin Herrick, an employee of Birdsall, testified that some of the transactions in Idaho Copper were between the accounts named as those of Rice, with no shares changing hands and commissions charged on only one side of the deals."

Marketing a Non-Metallic

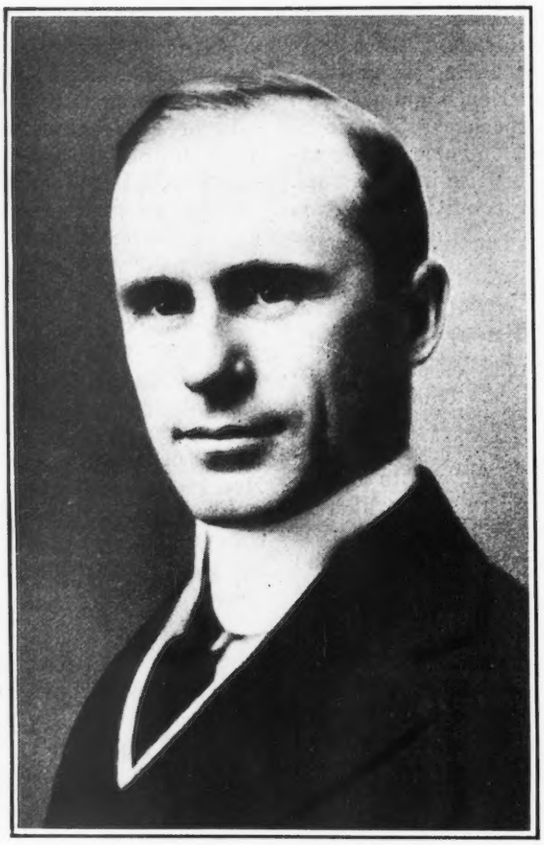
MARKETING NON-METALLIC MINERALS is not altogether an easy thing to do, as many owners of such deposits will readily testify. The difficulties are numerous, but the principal one is that important users of such minerals have their own deposits or have special deposits tied up by long-term contracts and are not especially interested in any other of the same kind, unless their source of supply is nearing exhaustion. They are then in the market to buy a deposit or to close a contract. The owner of a deposit has the alternative of converting his raw mineral product into commercial form and organizing a sales force to sell it to users. This may involve a commercial as well as a mining enterprise, which most miners are reluctant to undertake, either on account of lack of capital or because of the long period required to develop a demand for a given commodity. Nevertheless, human ingenuity and courage will often find a way.

Not long ago our notice was attracted by a mineral display in a store in one of the large Western cities. The mineral exhibited was epsomite, and it was shown in the crude as well as the manufactured state. An attractive name had been given to the product, which was being sold both at wholesale and retail for bath purposes. The owner of this deposit has established stores in several cities and is engaged in establishing a business. The important point is that the producer is also the manufacturer and distributor and thus can exercise control over the entire business.

Mining Engineers of Note

James Latimer Bruce

THOUGH the rule has its exceptions, the traits that a man displays in matters of minor importance are a pretty good guide to his true character. With respect to the subject of this sketch, it may be said that his methods of driving an automobile fairly reflect his conduct in the more momentous affairs of life. When he was manager for the Butte & Superior company at Butte he had a large Pierce-Arrow car with a chauffeur. However, when he was in the car he invariably drove it himself; not that he lacked confidence in the driver, but that it was natural for him to take the helm personally. He is self-reliant. For recreation he frequently drove a few friends over to the Madison River, a hundred miles away, to fish. New companions often experienced the fastest automobile trip over mountain roads they ever made; not that he is reckless, but because when he sets out to accomplish anything he concentrates all his energy on the problem in hand, whatever it may be, and finishes it as expeditiously and efficiently as he can. He is a hard but skillful driver; and he is a hard and effective worker. On the other hand, when driving in the city no one could be more careful or more regardful of traffic regulations. In the same way when occasion demands he is prudent and cautious in business affairs, and he has no inclination for ignoring the rights of others. When one first meets him the impression is of a very quiet, rather slow-spoken person, economical of words; but on better acquaintance one finds that he is an exceptionally quick thinker, that when he does speak it is after careful consideration, and that the paucity of words is made up for by the thought that is behind them. James Latimer Bruce was born in Ireland, of Scotch-English ancestry, in 1880, his family coming to Canada and going thence to Denver, Colo., in 1893. He was graduated from the Colorado School of Mines in 1901, his first job being that of chemist and assayer at the Little Johnny mine of the Ibex Mines Co., at Leadville. He was successively draughtsman and engineer in Cripple Creek; chief engineer and mine foreman for the Federal Lead Co., at Flat River, Mo.; assistant manager for the Grace Zinc Co., and manager for the Continental Zinc Co. at Joplin, up to March, 1913, changing from one position to another as the prospect seemed better. Perhaps his biggest job was that of opening, equipping, and operating, during its most prosperous days, the Black Rock mine of the Butte & Superior Mining Co., for which he was manager from 1913 to 1920. During this period he married Leah S. Hills at Denver. They have four children, two sons and two daughters. There is something of the adventurer in Mr. Bruce's make-up, for he left a "safe" berth with the Hayden-Stone-Jackling interests to accept the management, under an alluring though somewhat speculative contract with the Davis-Daly Copper Co. at Butte. Here he reorganized operations, re-equipped the mine, and was prepared for economical production when controversy over apex rights loomed on the horizon. When in 1924 Anaconda bought the Davis-Daly property to effect a settlement of this dispute, Mr. Bruce opened an office in Salt Lake City as a consulting engineer. For this he was well equipped by reason of his wide experience in mine and mill construction and operation, in mine examination and valuation, in geology, in mining litigation (in which he has had extensive experience in apex and patent issues) and in various other technical and economic phases of mine management. On Aug. 1 of this year he accepted an appointment as vice-president and general manager for the Cyprus Mines Corporation. Cyprus was the source of most of the Romans' supply of copper, the modern name for the metal being derived from the name of the island. He is now in Cyprus, where his task is to exploit by modern methods copper deposits that probably produced as early as 3,000 B. C., and that passed successively under the domination of the Egyptians, Assyrians, Phœnicians, Greeks, Russians, and Romans. The job is one to test the talents of any manager, but Mr. Bruce thrives on difficult, technical, and economic problems, and it is safe to say that he will make money if any is to be made. Having made his headquarters in several important mining centers, Mr. Bruce has a wide acquaintance among the leaders of the industries. He is highly regarded by all who know him. The many men who have worked for him particularly value his fairness, helpfulness, and friendship.



JAMES LATIMER BRUCE

An Apparatus for Studying Gases of Explosives Detonated Under Confinement*

Must Be Both Heavy and Delicate—Early Investigations Cover Period of Fifty Years—New Device Developed in Bureau Experiment Station

By J. E. Crawshaw† and G. W. Jones‡
Experiment Station, Bureau of Mines, Pittsburgh, Pa.

WHEREVER explosives are used underground the composition of the gaseous products of detonation, and the factors influencing the composition of these products, become important, particularly because practically all explosives on detonation give off greater or less quantities of poisonous gases, which may affect the health of the miners or cause much loss of time while waiting for the gases of combustion to be cleared out of the workings.

G. W. Jones

J. E. Crawshaw

The ideal method of making a study of the gaseous products from explosives would appear to be from blasts in a mine under actual mining conditions. However, this method has some serious objections, chief of which are: (1) The difficulty in obtaining representative samples of a good degree of concentration; (2) conditions under which the blast is fired cannot be controlled sufficiently; and (3) the materials in which the blast is fired may take part in the reactions. Accordingly, it seemed preferable to make the study in a laboratory apparatus where conditions of confinement could be made to approximate actual mining conditions and the above-named objections could be overcome and the results later checked by blasting. This paper describes an experimental apparatus whereby the gaseous products of detonation may be obtained from explosives under confinement, and in a way approximate the conditions under which explosives are used in mines.

Previous Investigations Cover a Period of Fifty Years

For the last fifty years the composition of the gaseous products from detonation of explosives has occupied the attention of a number of investigators, each of whom developed an apparatus for his investigation, and a number of these apparatus will be briefly described.

Noble and Abel[1] were pioneers in this work, and used a heavy-walled bomb in which as much as 1,000 gm. of black powder could be fired in a space of one liter. The effect of weight of charge to capacity of bomb—that is, loading density—on the composition of the gaseous products was studied. This apparatus, however, was not used for high explosives.

Later, Noble and Abel[2] used a heavy-walled bomb of smaller size, about 45 cc. capacity, and fired charges that varied from a few to 14 gm., and determined the effect of density of loading on the composition of the gaseous detonation products from a variety of explosives.

Sarrau and Vieille[3] used a bomb of 300 cc. capacity in which experiments were made with nitrogen.

As a routine test Bichel's apparatus[4] was developed for use in the research laboratory of an explosives company, and is still the one most commonly used in explosives laboratories for the determination of the products of detonation. This apparatus is much larger and stronger than those used by previous investigators and allows safe use of larger charges of high explosives, up to 300 gm.

The apparatus consists essentially of a steel cylinder 80. cm. in length and 50 cm. outside diameter. The cavity within the cylinder is 48.3 cm. deep and 20 cm. in diameter, and has a capacity of approximately 15 liters. A steel head closes the cylinder and is held in place by twelve heavy steel bolts and an iron yoke. Means are provided for firing the charge, evacuating the cylinder, recording the pressure, and drawing off the gases.

It will be seen that the density of loading with this apparatus is low, as the explosive charge occupies only a small part of the 15-liter space.

To increase the rapidity of cooling of the explosion gases, Poppenberg and Stephan[5] loaded explosives in their own volume in sealed lead, steel, and porcelain bombs, the charge being just large enough to break the bomb. These were detonated within a larger steel bomb which was evacuated before the test was made. However, only small charges, 1.5 to 10 gm., could be used in this apparatus. In some tests[6] the explosives were detonated in double-walled lead or glass vessels, the space between the walls being filled with water or mercury.

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†Explosives engineer, U. S. Bureau of Mines.
‡Associate chemist, U. S. Bureau of Mines.

[1]Noble, A., and Abel, F.: *Phil. Trans.*, 165, 1875, p. 12, and 171, 1880, p. 203.

[2]Noble, A., and Abel, F.: *Proc. Royal Soc.*, 56, 1894, p. 205. *Phil. Trans.*, 205, 1905, p. 201, and 206, 1906, p. 453. *Z. ges. Schiess Sprengstoff*, 1, 1906, p. 4.

[3]Sarrau, E., and Vieille: *Proc., Mem. Poudr. salp.*, 2, 1884-85, pp. 126 and 337.

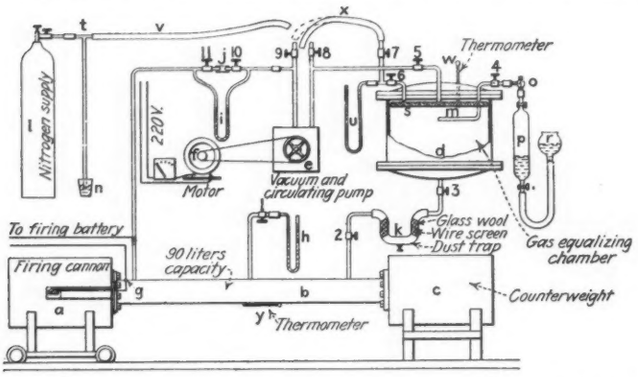
[4]Bichel, C. E.: *Z. Berg. Hütten Salin*, 50, 1902, p. 669.

[5]Poppenberg, O. and Stephan, E.: "Ueber die Zersetzung von Pulvern and Sprengstoffen," *Z. ges. Schiess Sprengstoff*, 4, 1909, pp. 305 and 281.

[6]Poppenberg, O.: *Z. Angew. Chemie*, 36, 1923, p. 80.

Robertson and Garner[7], who were especially interested in the calorimetry of high explosives, made use of a V-shaped steel bomb with a free space of 235 to 240 cc. The charge of explosive, in pellets of 3.5 to 4.5 gm., confined in a steel cylinder with walls 0.25 in. thick, was fired in a vacuum.

Audibert[8] used Trauzl lead blocks for studying the



Sketch showing details of apparatus, and accessories used in tests conducted

gaseous detonation products from explosives. The explosive charge was placed in a cylindrical cavity 25 mm. diameter and 125 mm. deep in the block. A steel yoke with a truncated cone fitting in the opening tightly closed the cavity. The volume of the cavity was approximately 51.5 cc. The force of the explosive was expended in enlarging the chamber in the Trauzl block, from which by suitable arrangement the gases of detonation were withdrawn for analysis. Charges of less than 20 gm. were used in this apparatus.

It is seen, therefore, that practically all apparatus which have been used for studying the detonation products from explosives under confinement must from necessity use small charges, less than 25 gm., otherwise the force of the explosion is so great that the apparatus will not stand the pressure.

Work of Present Investigators Simulates Mining Conditions

The apparatus used by the writers was not designed to give detonation products approaching those which would result if the gases were cooled instantaneously, but rather detonation products approaching those given by an explosive under actual mining conditions. The conditions which it was especially desired to simulate were:

(1) The use of fairly large charges; (2) a fairly rapid rate of cooling, by conduction, radiation, and expansion, because under actual mining conditions the explosive is surrounded by large masses of material and the detonation products are rapidly released into large volumes of air; (3) a confinement representative of mining conditions; and (4) detonation in contact with the different minerals.

To meet the conditions set forth a pressure apparatus was developed. In this, charges of 150 gm., or larger, can be used; the explosive can be packed in the back of a rugged metal cannon sufficiently large to withstand the pressure developed; and the gases, instead of being confined as in a bomb, are discharged into a heavy wrought-iron pipe containing air or nitrogen. The air or nitrogen acts as a cushion to modify the pressures developed and cools the gases. The amount of confinement can be varied by the method of loading the explosive into the borehole and the amount and kind of stemming packed in the borehole against the explosive. The materials, the effect of which it is desired to study, can be readily packed around the explosive.

Description of Apparatus—The apparatus a sketch of which is shown herewith consists of two parts, as follows:

Part I consists of (1) a firing cannon *a* which is a forged steel cylinder 24 in. in diameter and 36 in. long, and has a borehole 2¼ in. in diameter and 21½ in. long. It is mounted on a movable truck so that it can be moved to and from the pipe *b* for loading the cannon and cleaning the chamber *b;* (2) an expansion chamber *b*, which is a piece of 8-in. extra strong lap-welded wrought-iron pipe 10 ft. long, flanged at each end and bolted to the cannon and counterweight *c* by twelve ⅞-in. steel bolts; (3) a counterweight *c* of the same dimensions as the cannon *a*, to stabilize the apparatus when the explosive is fired from *a*.

Part II consists of the pressure equalizing, mixing, and sampling devices. By partly evacuating the equalizing chamber, *d*, before firing at *a*, the pressure in expansion chamber *b* can be released into it immediately after a shot, with a resultant pressure in the whole apparatus of slightly more or slightly less than atmospheric, which lessens any tendency to leak during the cooling and mixing of the gases. The pump, *e*, is used to evacuate the equalizing chamber *d*, for mixing the gases and sweeping out the entire apparatus after each test.

Charges of from 150 to 200 gm. are used in each test. This charge of explosive gives detonation products of a good degree of concentration and does not produce excessive pressures within the apparatus at the instant of detonation, and the effects of the products from the detonator can be disregarded. In addition, charges of this size can be packed in the borehole in the same manner for each shot.

Test Procedure—In a general way the procedure of testing is as follows: The stud bolts which hold the firing cannon *a* to pipe *b* are unscrewed and the cannon is rolled back out of the way. A scraper is used to clean the pipe of tamping material and foreign material from the previous test, and the first 3 ft. of the pipe next to the firing cannon is wiped out thoroughly. The borehole of the firing cannon is then cleaned of residue from the previous test and the explosive and electric detonator are charged in the cannon according to the desired method.

Stemming is then inserted in the borehole and tamped firmly against the explosive. The ends of the lead wires of the electric detonator are then cut off at the proper length and one lead is fastened to a screw in the face of the cannon.

When the apparatus has been cleared of gases from the previous test the cannon is rolled close to the pipe, and the other lead wire from the electric detonator is joined to the firing plug *g*. The cannon is then rolled against pipe *b* and made gas-tight by screwing down the stud bolts. Valves 2, 3, 4, 7, 8, and 10 are then closed and valves 5, 6, and 9 (tube *v* being disconnected from 9) opened and the pump is started, thus evacuating the air from chamber *d*. When a vacuum is pro-

[7]Robertson, R., and Garner, W. E.: "Calorimetry of High Explosives," *Proc. Royal Soc.*, A-103, 1923, p. 539.

[8]Audibert, E.: "The Explosive Decomposition of Nitroglycerin," *Compt. rend*, 178, 1924, pp. 1167-1169.
Audibert, E.: "La Securité du Tir en Milieu inflammable," *Annales des Mines*, Aug., 1924.

duced in the chamber, *d*, sufficient to take care of the volume of gas it is estimated will be liberated by the explosive, valves 5 and 9 are closed and the pump is stopped and valve 11 closed. The charge of explosive is detonated by means of an electric detonator fired by means of a push-down battery and the gases liberated into pipe *b* by the explosive quickly released into the chamber *d* by opening valves 2 and 3. Valves 5, 10, and 11 are then opened and pump *e* is operated, which circulates the gases through the pipe, equalizing chamber, and pipe connections. Tests have shown that five minutes of circulation is sufficient to thoroughly mix the gases. At the end of five minutes the pump is stopped and the pressures are read on manometers *h* and *u* and the temperature by thermometers *y* and *w*. The pump is then operated five minutes more and the temperature and pressure again noted. These last values are used in the calculations of results.

Sampling the Gas—A sample of the gas is then withdrawn for analysis by means of sampling tube, *p*, and mercury leveling bottle, *r*. Cock, *o*, is opened to connect the sampling tube with outside air, the cocks on the sampling tubes are opened and mercury leveling bulb, *r*, is raised, which cause the tube to fill with mercury. When the mercury reaches cock, *o*, this is turned to connect with the pipe leading to the interior of the apparatus. The mercury leveling bulb is then lowered and thus draws out a sample of gas from the drum. This sample is discarded because it contains air in the connection, and a second sample is withdrawn in the same manner as previously given.

Analysis of Gas—The sample of gas thus obtained is then analyzed for carbon dioxide, oxygen, carbon monoxide, hydrogen, and methane on a Bureau of Mines Orsat apparatus.[9] Oxides of nitrogen are tested for in a separate sample. The nitrogen is determined by difference. Knowing the volume of the entire apparatus, the temperature and pressure of the gas and its composition as given by analysis, the amounts of the different constituents produced by the explosive can be computed.

Accessories to Apparatus—The orifice *j* was placed in the circuit to indicate on the flowmeter *i* how the pump is operating in circulating the gases through the apparatus. High rates of flow of gas are shown by large differences of level in the two columns of liquids in the flowmeter.

The pump, *e*, is of the friction-plate type and can be used for either vacuum or pressure. It is best to operate the pump with the minimum amount of lubricant sufficient to give the vacuum desired, so that equilibrium is quickly obtained between the gases and oil, with very little effect on the gases. "Nujol," a medicinal lubricant, is used for the pump. This oil has a high flash point and proved satisfactory for this work. A low-flash-point oil is undesirable, because it gives off volatile constituents which will contaminate the gases from the explosives. A dust trap *K* was found necessary to prevent stemming and coal dust from getting into the drum and pump of the apparatus. It was necessary to clean it out after every fifteen to twenty tests and replace with a new packing of glass wool.

An attempt was made to put a thermometer well into pipe *b* for recording the temperature of the gases, but in every case the wells were broken off by the force of the explosion after one or two tests. Temperatures of the gas in the pipe were obtained by placing a thermometer along the bottom of the pipe, then placing a copper shield over the mercury bulb in contact with the pipe, and this in turn covered with insulating material. The thermometer responded very quickly to change of temperature of the pipe. Temperatures were recorded in two places because ten minutes after shooting the pipe was from 1.5 to 2.0 deg. higher in temperature than other parts of the apparatus. The two values were averaged.

For the calculation of test data the following typical example will serve to illustrate the procedure:

Volume of pressure apparatus including all parts, liters	179.3
Weight of explosive used, gm	162.1
Average temperature of cooled gases, deg. C	+5.0
Average manometer readings, mm	—19
Volume of space occupied tamping in borehole, liter	0.5
Corrected volume, liters	178.8
Barometric pressure, mm. of Hg	734
Corrected pressure = 734 — 19, mm. of Hg	715
Corrected temperature = 273 + 5, deg. C	278
Volume corrected to 0 deg. C. and 760 mm. pressure, liters	165.2

Composition of gases in apparatus after test:

Constituent	Per Cent by Volume	Liters of Gas Per 100 Grams of Explosive
Carbon dioxide	11.6	11.85
Oxygen	12.5	12.75
Carbon monoxide	3.2	3.25
Hydrogen	2.0	2.05
Methane	1.0	1.00
Nitrogen	69.7	71.00

The number of liters of gas is obtained by multiplying the percentages of gases given by analysis by the liters of gas in the apparatus and dividing by the weight of explosive used.

To date more than 250 tests have been made with the apparatus described. At the start difficulties were experienced in obtaining gaskets which would withstand the high pressures in the pipe. Some would only last for two or three tests. A corrugated copper gasket with asbestos pressed into the corrugations was found to give good results. Trouble was also experienced keeping the many valves tight until soft metal seats were obtained. The first wrought-iron pipe was broken after about forty tests had been made.

These difficulties having been overcome the apparatus has proved very satisfactory and reliable for studying the effects of confinement on the composition of the gaseous detonation products from permissible explosives, the effects of coal dust on the gaseous products, and other variables.

The results of these tests are to be published by the Bureau of Mines as separate reports in the near future.

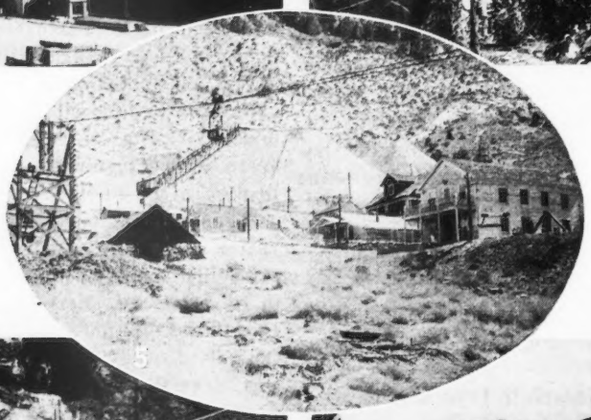
The authors wish to express their appreciation of the many helpful suggestions given them during this investigation by George S. Rice, chief mining engineer, and A. C. Fieldner, chief chemist, Bureau of Mines.

[9]Burrell, G. A., and Seibert, F. M.: The sampling and examination of mine gases and natural gas. Bull. 42, Bureau of Mines, 1913, 116 pp. Revised in 1925 by G. W. Jones and in press as Bulletin 197.

Oil Development in Alberta

Prospects for the development of a large production of oil in Alberta, Canada, have, according to Dr. G. S. Hume, of the Geological Survey of Canada, never appeared more promising than now. This expectation is based particularly on the geological conditions and production in the Turner Valley field, southwest of Calgary, and in the Wainwright field, 120 miles east of Edmonton. Many areas on the plains and foothills have been drilled, and in a number of places large gas fields have been developed, but outside of the Turner Valley and Wainright fields no commercial production of oil has yet been secured, although numerous "shows" of oil have been found.

Some of the Mines of Inyo County, California



1, Benton Mining & Development Co.'s 800-ft. prospect tunnel, near Benton. 2, Prospect tunnel of Comanche Mining Co., near Benton. 3, Portal of Troeger tunnel, east of Keeler. 4, Above timberline, at Tungsten Products Co.'s mine, west of Bishop. 5, The Cerro Gordo mine at Cerro Gordo. 6, Entrance to Defiance mine, at Darwin. 7, Prospect tunnel of Pierson Mine Co., at Independence

Mines and Minerals of Inyo County, California

Cerro Gordo in Ore—Exploration Activity at Darwin and Other Places in Inyo Range—Tungsten Mining Reviving—Non-Metallics Command Attention

By George J. Young
Associate Editor

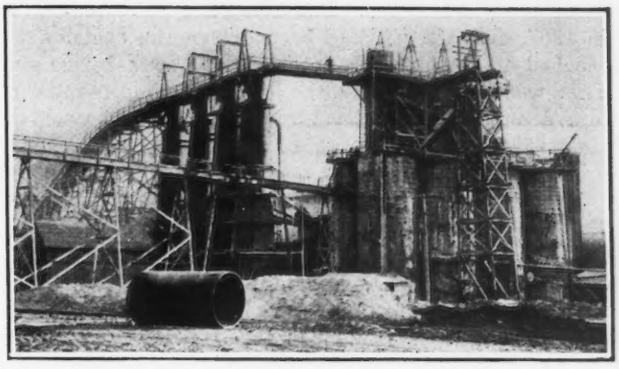
INYO COUNTY, CALIFORNIA, is a region of sharp contrasts, topographically, geologically, and in climate. Mount Whitney on the west and Death Valley on the east represent the extremes in altitude. Cambrian metamorphics, the Silurian, Devonian, Carboniferous, and Triassic are in close association with plutonics and Tertiary volcanics and lake beds. Extensive deserts of extreme aridity are not a great distance from the alpine meadows of the Sierra. Mining history in this region goes back to the discovery of Cerro Gordo by Pablo Flores and two other Mexicans in 1865 and includes the fiasco at Greenwater and the exploits of "Scotty," of later date. The present status of mining in this county is of interest.

Geological literature of the region is scanty. The most comprehensive paper is Knopf's "Reconnaissance of the Inyo Range and the Eastern Slope of the Sierra Nevada[1]." Hobbs, Rockwood, Trowbridge, Whitney, Johnson, and Eakle have made short contributions on subjects of general geologic interest. The metal-mining history centers about Cerro Gordo and Darwin, but many small mines and prospects have appeared at different times. Long-continued operation apart from a few instances has not characterized the numerous smaller properties. Difficulty of access as well as of transportation has militated against the region in general. Climatic conditions and water scarcity have also played a part. Nevertheless there exists a relatively great area which will be combed over again and which may be expected to yield workable deposits of clays, commercial non-metallics, and metal mines.

The Cerro Gordo mine has been and continues to be one of the most interesting mines of Inyo County. It includes a series of veins and accompanying oreshoots of silver-lead ore in carboniferous limestones in the immediate vicinity and to the west of Cerro Gordo peak, in the Inyo Range. The total production from a comparatively restricted area is variously given as between $15,000,000 and $20,000,000 since discovery. The property has been worked intermittently. Its early history is given by W. A. Chalfant in his interesting book, "The Story of Inyo." The later history begins around 1908, when Lloyd D. Skinner and his brother W. Skinner undertook the operation of the mine. They were successful for a considerable period, and when the company discontinued operation a lease was given to them. As a result of their exploration campaign, a new ore zone on the "east belt" was opened up on the 400, 700, and 900 levels. The east vein was bottomed at the 1,150 level, where it was cut off by limestone. The orebody was worked below the 700 level. At this time, 1912, L. D. Gordon secured the lease on the property at the expiration of the Skinner lease and organized the Inyo Cerro Gordo Mines Co., which operated the lease successfully under the advantageous conditions left by the Skinners. Gordon operated for seven years, and mined out all of the ore in the east vein, finally leaving the mine in a practically worked-out condition in 1919.

[1]Professional Paper 110, U. S. Geological Survey, 1918.

After being idle for two years, the company resumed operation in 1921. A 50-ton flotation mill was installed, but very little was accomplished and the property was closed down in 1923. A short time thereafter the Natural Soda Products Co., controlled by the Watterson Brothers, of Bishop, Calif., secured a lease-and-purchase



Plant of Natural Soda Products Co., south of Keeler

option for two years. Under this lease exploration was begun in the north end of the mine, but this work was unproductive. Chiefly under the advice of L. D. Skinner, exploration was directed to the southwestern area from the 900 level. The crosscut driven into this area intersected an orebody last September. Production was made to the amount of several hundred tons of shipping ore, and preparations were being made at the time of my visit to the property, late in September, to drive crosscuts from the 700 and 1,100 levels. The importance of the discovery remains to be proved by additional exploration.

The Natural Soda Products Co. also operates a limestone quarry close to the Cerro Gordo mine and transports both ore and limestone to Keeler by a wire-rope tramway. The upper terminal of the tramway is at an approximate elevation of 8,500 ft. and the lower at 3,600 ft., a difference of elevation of about 5,000 ft. The limestone is transported in railroad cars from the lower terminal to the company's plant a short distance southeast of Keeler.

Southwest of the Cerro Gordo mine the Estelle Mining Co. is exploring the limestone formations from a 700-ft. raise connecting with the Troeger tunnel, the portal of which is at an altitude of 6,010 ft. The company controls a large area adjoining the Cerro Gordo holdings on the south. The present length of the Troeger tunnel is 8,100 ft. The tunnel course is N. 55 deg. E., crosscutting the formations. The raise is at a point 7,600 ft. from the portal. Two levels, at 140 and 340 ft. above the tunnel level, have been opened out, and a new level was being started at 660 ft. The situation is unique in that exploration operations are directed upward from an adit. Several small orebodies were found on the tunnel level and were more or less stoped. The Morning Star mine, high up on the slopes of Cerro Gordo peak,

Talc grinding and shipping plant at Keeler

was opened by a shaft and by an adit, and ore production made at various times. The Troeger tunnel was started in 1907, and after it had been driven the decision was reached to explore the intermediate zone by raising. This was influenced by the disappointing results obtained on the tunnel level. Production this year was about $25,000 to the end of September. In 1924, a production of $60,000 was made and in 1923, $30,000.

The Troeger tunnel is equipped with a model plant. The two-stage compressor is a short belt drive of 670 cu.ft. capacity and is driven by a 100-hp. motor. A blower driven by a silent chain and 15-hp. motor supplies ventilation through a 12-in. galvanized iron air pipe. Connections are arranged for direct pressure and for exhaust. Both compressor and blower are placed inside the tunnel portal in a large station excavated in the limestone at one side of the tunnel. The tunnel is 7x7 ft. in cross-section for 7,300 ft. and 5x7 ft. for the remaining length.

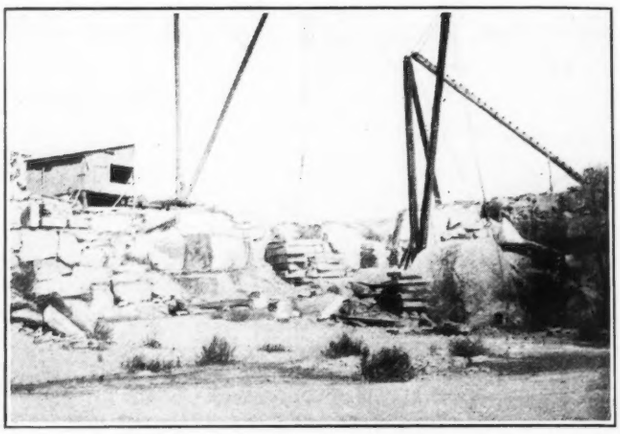
Compressed air is carried in a 4-in. pipe. Practically no water was encountered in the tunnel. The raise is 5x13 ft. inside dimensions and is divided in two 4-ft. compartments and one 3½-ft. ladderway. A compressed-air hoist is used for handling men and tools. One of the compartments is used as a waste transfer. Haulage in the tunnel is by 25-cu.ft. cars equipped with spring draw heads and roller bearings. A 3-ton storage-battery locomotive is used for haulage.

The track is 20 lb. rail, 18-in. gage. CC 11 stoper and DCRW 23 are used in drilling. A drill-sharpening and blacksmith shop equipped with a sharpener, forges, and air hammer is available at the portal. In addition, a boarding house, an office and a timber-framing shed are placed close to the portal. The water supply is unique in that water is pumped from Keeler through a 1¼-in. pipe line 25,000 ft. long and against a head of 2,500 ft. The first 10,000 ft. of pipe is extra heavy, and the remaining 15,000 ft. is of standard weight. A small triplex pump driven by a 7½ hp. motor is used for the service. The rate of flow is 5 gal. per minute, storage being provided for 15,000 gal. Pumping is done twice a month at a monthly cost of $11. Thomas L. Chapman is in charge of the mining work.

At Darwin, southeast of Keeler, the American Metals, Inc., of Chicago, controlled by C. H. Lord, is exploring the Defiance, Lucky Jim, Promontory, and Lane groups of claims. The present company, under the management of H. E. Olund, has initiated a campaign of exploration for new orebodies and is trying out the modified Chilson method of electrical prospecting. Other activity in the Darwin district is confined to the work of a few prospectors. The Acme Mining Co. started an open cut on low-grade ore on the east side of Darwin hill and hauled ore to a leaching plant close to the plant of the Natural Soda Products Co., but the plant operation as well as the mining work was discontinued.

Darwin produced a considerable amount of silver-lead ore, and a number of mines were successfully worked, but apart from low-grade ore in a few of the older properties the hope of the future appears to lie in the discovery of new orebodies in the limestone.

At Tecopa, the Tecopa Consolidated Mining Co. is shipping about 750 tons per month of silver-lead ore. Panamint, on the west side of the Panamint Mountains, was the scene of a mining excitement in 1873. Many companies were organized, and a 20-stamp mill was constructed, but the camp petered out in 1877, according to Chalfant. At present the Panamint Mining Co. has acquired most of the old claims and is engaged in driving a 2,800-ft. tunnel in the expectation of cutting



Bly stone quarry, west of Bishop

the veins at depth and, if unsuccessful, to raise and get what ore remains in the area once worked. W. L. Seeley is manager for the company. A road is being constructed connecting "Panamint City" with Surprise Canyon, a distance of 5½ miles.

The Gibraltar mine, a silver-lead property, southeast of Ballarat, is being worked and a road is being built. In the Slate Range near Ophir a silver-lead property is being worked by J. W. Kelley and his associates, of Los Angeles, under the name of the Engineers Exploration Co. Other lead properties have been operated in the Slate Range. At La Moine, in the west side of Death Valley, about a carload of silver-lead ore is being shipped per month. The ore is hauled 60 miles to the Tonopah & Tidewater Railroad.

Inyo County is constructing a new road connecting the Darwin road to Saline Valley. At Saline Valley many branch roads will connect with the new road. It is expected that ore shipments will be made from a number of prospects which have hitherto lacked transportation.

Mines North of Owens Lake

Northeast of Lone Pine about 11 miles distant is an interesting property known as the Union mine. The vein cuts transversely into the Inyo Range in the Triassic formations and dips to the north at a high angle. It dominates a spur of the mountains, the outcrop being easily discernible and is said to be about 6,500 ft. in length. Small open cuts have been made in the outcrop. Five drifts have also been extended, four being in the veins, and the lowest, 300 ft. in length, was

stopped before it cut the vein. The aggregate length of drifts in the vein is 1,715 ft., the vertical range from No. 2 to No. 4 drift being 804 ft. The vein ranges from a few feet in width up to 20 ft. Ore has been found at a number of places along the outcrop and in the drifts. The prospect was first discovered in the '60s, and was located in 1897 by W. Skinner and his associates. A small experimental mill was erected in 1914, but operations were discontinued. Gold, silver, and lead values are obtained at a number of points. It is surprising that a vein so favorably situated and possessing the persistence and width that this one does should not have been thoroughly explored. As it is, it is a challenge to mining men, and no doubt the attention it so evidently deserves will be given to it at some time.

Opposite Independence, in the Inyo Range, the Pierson Mine Co. is driving an exploration tunnel into the Carboniferous limestones with the objective of discovering blind veins. One vein system which outcrops on the surface has been cut at a point 700 ft. from the portal. The present length of the tunnel is 3,000 ft. It is 7x8 ft. in section. The plant is excellent. Power is supplied by a 200-hp. Diesel engine direct-connected to a 1,015-cu.ft. angle-compound compressor. This is now being operated on a single shift per day and consumes 48 gal. of fuel oil and one gallon of cylinder oil at a cost of about $15 per day for both labor and supplies. Two 248 Leyner drills are used. A Hoar shovel was used at one time, but its use has been discontinued. A 3½ ton storage-battery locomotive is used for haulage. C. D. Horton is in charge of the operations. The company is

Salt crust in Death Valley

controlled by R. B. Whiteside, of Duluth. Apparently nothing of interest has as yet been discovered.

Southeast of Big Pine and in the foothills of the Inyo Range is the Montezuma mine. This was recently taken over by Buol and Degenhart, who are now shipping about 500 tons of medium-grade silver-lead and zinc ore per month. Both carbonate and sulphide ore is shipped. A crew of ten men is employed. In extending a crosscut from an upper level in the mine, a vein of free-milling gold ore, 18-in. in width, was struck, assaying over two ounces gold per ton. This is unusual, as heretofore only silver-lead ore has been found. A. W. Degenhart is superintendent. The company is the Montezuma Mines Co.

West of Bishop, a number of tungsten properties were worked during the war. These were the Tungsten Products Co., the Tungsten Mines Co., Round Valley Tungsten Co., and the Standard Tungsten Co. All of the properties have been idle for several years with the exception of the Tungsten Products Co., which resumed operations in 1925. It is expected that the Tungsten Mines Co., which was acquired in 1925 by Watterson Brothers, will resume operations this winter. Tungsten Products Co. is milling 200 tons per day and shipping concentrates. It is at an altitude of 11,000 ft. in the Sierra on Pine Creek, 20 miles west of Bishop. The Standard was closed down in 1918 and the property dismantled. Round Valley Tungsten Co. has been idle since 1920. Wilshire mine, a low-grade gold property in Bishop Park in the Sierra, is idle after several attempts to maintain it in operation.

North of Bishop in Mono County, near Benton, the Benton Mining & Development Co. is driving a prospecting tunnel into Blind Springs Hill. The tunnel crosscuts the hill in a southwest direction. It is between 700 and 800 ft. long. The equipment consists of a portable compressor, a fan operated by a 6-hp. gasoline engine, hammer drills, and blacksmithing tools. Two veins have been cut by the tunnel, which is being driven by J. D. Harvey, contractor.

A short distance north, the Comanche Consolidated Mining Co. has started a crosscut tunnel and has extended it 200 ft. The equipment consists of a semi-Diesel-driven compressor and a gasoline engine for operating a ventilating fan. Turbine and clipper drills, mounted, are used in the tunnel driving. Both of the tunnels described in the foregoing are on the east side of Blind Springs Hill and are expected to cut at depth veins formerly worked at higher levels.

Non-Metallic Minerals Abundant

Inyo County has long been the center of borax production, the principal production coming from the colemanite deposits of the Furnace Creek area of Death Valley. This continues to be the principal source of the borax handled by the Pacific Coast Borax Co. In the Owens Lake area trona and soda ash have been marketed for many years. The principal source of the soda compounds has been from the waters of Owens Lake. These were obtained by solar evaporation. The Inyo Development Co. was the pioneer in the work. Subsequently the California Alkali Co. established a plant on the west side of the lake at Cartago and the Natural Soda Products Co. another plant south of the Inyo Development Co.'s plant, which is close to Keeler. The Los Angeles aqueduct was formally dedicated on Nov. 5, 1913. Since that time Owens Lake has been deprived of most of its inflow and has gradually dried up.

Fault in limestone formations in Cerro Gordo ravine alongside of road from Keeler to Cerro Gordo

It is now no longer existent. With the drying up of the lake, the rapid increase in the density of the lake water interfered with the operations of the three soda plants, and production ceased for a time. The Natural Soda Products Co. was acquired by the Watterson Brothers and subsequently the property of the Inyo Development Co. By developing a novel method for handling the impure trona deposits, the Natural Soda Products Co. was revived, and substantial production has continued. The Cartago plant, which was started in 1917, also resumed operation under the name of the Inyo Chemical Co., and is now producing. Important production is being made at both plants. The vats and pumping equipment of the Inyo Development Co. are at the present time being used by the Natural Soda Products Co.

Range Contains Talc and Dolomite Deposits

Talc is being produced by the Inyo Talc Co. from a mine about 20 miles southeast of Keeler close to the Darwin road. It is hauled by trucks to Keeler and ground in a Raymond mill. Various products are also cut from the lump talc. A production of about 20 tons per day is maintained. Other talc deposits have been discovered in the Inyo Range, and several have been worked.

A dolomite formation occurs in the low ridge of the Inyo Range several miles north of Keeler. Three quarries have been opened out in this formation, two of which supply dolomite for burning and one of which supplies varicolored marble, which is crushed and shipped for ornamental stonework. Near Bishop, the Bly Stone Co. is operating a dimension stone quarry and supplying building stone for shipment to Los Angeles. The stone is a volcanic tuff of good color and texture. Along the line of the Tonopah and Tidewater shipments of talc are being made from Silver Lake. At Bradford filtering clay in quantities exceeding a car a day is being shipped. Silica is also being shipped from Ralston to Los Angeles. Borax shipments from the Death Valley region are reduced in amount compared to those of former years. This is due to competition in borax production from Searles and also from Las Vegas, Nev.

Determining Platinoids in Samples

In the case of the recently discovered platinum ores from the Waterberg and Lydenburg districts, in Africa, the former containing platinum and palladium with scarcely any osmiridium, and the latter platinum with a small quantity of osmiridium apparently alloyed with iron, fusion on the lines of the ordinary gold assay, taking one assay ton to five assay tons, seems the most suitable method of treatment, according to G. H. Stanley in the *Journal* of the South African Chemical Institute (abstracted in *Journ. Soc. Chem. Ind.*, Nov. 13, 1925). Fine grinding and much borax may be necessary, and care should be taken to avoid "salting" during grinding. E. A. Smith's method ("Sampling and Assay of the Precious Metals") is applicable, but cupellation should be carried on until two-thirds of the lead has been removed, and then finished at a higher temperature. The bead is weighed and inquarted with at least ten times as much silver as platinum, parted by boiling in 15 c.c. of sulphuric acid (9 parts of acid and one part of water) for 15 minutes, and finished in 5 c.c. of concentrated acid for 10 minutes, checks being used if silver is to be determined. Palladium and rhodium dissolve with the silver. Great care is necessary in decanting the solution from the residue which contains platinum, together with gold, osmiridium, iridium, and ruthenium, and which should be rapidly annealed and weighed (a). The osmiridium and iridium may then be separated by treating with aqua regia, which dissolves the gold and platinum and possibly small quantities of iridium and ruthenium. The solution is evaporated with hydrochloric acid, and platinum, together with any iridium and ruthenium, is precipitated by ammonium chloride; the precipitate is dissolved in hot dilute sulphuric acid, reprecipitated by hydrogen sulphide, filtered off, and scorified with lead after adding six times as much silver as platinum.

After parting and cupelling, the platinum is weighed. The filtrate from the ammonium chloroplatinate may be made alkaline with caustic soda, and the gold precipitated by hydrogen peroxide, collected, cupelled, and weighed. The sulphuric acid solution is diluted, the silver precipitated by hydrocloric acid and if pink (contamination with palladium) should be redissolved, and reprecipitated once or twice. From the filtrate palladium and rhodium may be precipitated by addition of zinc dust in excess, and after setting and decanting, the residue is treated with dilute hydrochloric acid. settled, filtered, and the residue cupelled with lead and weighed (b). Then $(a + b) -$ gold $=$ platinoids.

Tin Ore and Smelting Costs

A good deal has been and is heard of the tardy response shown by tin production to increasing demand and phenomenally profitable prices, says the London *Metal Bulletin*, editorially. As a matter of fact, the shortage of tin supplies would be less pronounced, it goes on to say, if all the ore now being mined were being smelted. Smelting charges have been knocked down to such a wretched figure that tin smelting is not a very attractive business. In proof of this the inactivity of the German smelters may be cited, as well as the fact that all of the American refineries are now nonoperative.

It is sometimes contended that political reasons were in part responsible for the shutdown in the United States, but the ostensible cause was high costs, of which possibly expensive electric power formed an item. Perhaps, too, the inability of the American smelters to obtain Nigerian ore was a contributory factor, for nobody cares to treat Bolivian ore by itself. Be this as it may, the fact remains that the plants there being stopped throws greater supplies of ore on to the European market. With some of the smelters in Europe out of action, the capacity of those operating is strained severely to treat all the material available, and considerable stocks of ore are now in the hands of British smelters.

The advance in tin prices has led to materially increased interest being taken in mining ventures, but it avails little to win the ore if the terms obtainable are not sufficiently attractive to induce smelters to treat it. A revision in returning charges seems, therefore, inevitable, for smelters are today in a very strong position *vis-a-vis* the mines, and can afford to hold out for better terms.

The Genesis of Sulphide Ores

By Horace Freeman
Chemical Engineer, Shawinigan Falls, Quebec, Canada

Horace Freeman

DURING the course of a research in British Columbia several years ago, with a view to investigating methods for reducing ore mixtures of sulphides of lead, zinc, and iron, I was impressed by the lack of a readily acceptable definition of either the chemical or physical nature of the solutions which are supposed to have deposited these minerals. It is, of course, now well accepted that the metallic and non-metallic minerals comprising the vein fillings have been deposited in the presence of and partly by the agency of water and other volatile elements. These same conclusions also apply to the "igneous" rocks. That the vein minerals have not crystallized from a condition of dry fusion is proven by the following experiment:

A sample of massive mixed sulphide from the Sullivan mine was melted in an electric furnace, and the temperature of fusion found to be 1,380 deg. C. It remained quite liquid down to 1,200 deg. C. and solidified in a homogeneous mass which remelted at 1,200 deg. C. Thus, the heating of this ore produced a eutectic mixture which did not occur in the natural state. Also, the simple heating (without oxidation) had changed its composition by eliminating some sulphur.

Simple Solution in Water Cannot Account for Large Deposits

The sulphides of the base metals comprising the large ore deposits are exceedingly insoluble in water. So slight are their solubilities that simple solution in water certainly cannot account for the deposits of great size, such as occur in British Columbia and elsewhere, even if vast time and high pressures are assumed.

The sulphides are found deposited together, intimately mixed and occasionally in chemical combination. They are sometimes found as inclusions in the non-metallic gangue, and sometimes the gangue is found included in the sulphides. It is therefore fair logic to assume that one and the same solution has thrown down both ore-mineral and gangue and also that the various sulphides in the mixture possess one property in common by virtue of which they have been so intimately deposited.

In the course of my investigation of the properties of the individual sulphides, it appeared improbable that the sulphide ores could have been deposited by precipitation from soluble salts of the metals, since the conditions favorable to precipitation vary greatly for the different constituent sulphides. Furthermore, a solution carrying at once soiuble salts of all these metals, as well as the gangue minerals, has not yet been defined.

The investigation involved determination of the approximate fusing points of the common sulphides. These are all higher than 1,000 deg. C. It also led to the search for means of the reducing of these high fusing points. This was found in sodium sulphide. I have found that pure sodium sulphide is totally infusible in the electric furnace, but it dissociates at a white heat. In combination with all metal sulphides occurring in natural ores, it forms readily fusible double sulphides. The fusing points of the commoner sulphides and double sulphides are here given:

Sulphides, Melting Point Deg. C.		Double Sulphides, Melting Point Deg. C.	
PbS	1,130	$PbS:Na_2S$	650
FeS	1,000	$FeS:Na_2S$	660
ZnS	1,650	$ZnS:Na_2S$	620
Cu_2S	1,100	$Cu_2S:Na_2S$	560

Similar eutectics having melting points below 700 deg. C. are obtained with the sulphides of nickel, cobalt, manganese, molybdenum, arsenic, antimony, silver, gold. and cadmium. All these double sulphides with sodium are characterized by low melting points and low viscosities when fused.

I also found that calcium, barium, and strontium sulphides will fuse sodium sulphide, as will also silica. That is, these substances combine with sodium sulphide to form fusible compounds. In the case of silica it is probable that thio-silicates are formed, compounds in which sulphur plays the part of oxygen—$Na_2S:SiO_2$.

The sodium sulphide combinations with the alkaline earth metal sulphides, and with silica, are light viscous products having high melting points; and from these the easily fused heavy double sulphides of the metals readily separate.

The action of water and air (oxygen and carbon dioxide) upon all these combinations is notable. Certain of the double sulphides of sodium and other metals are readily broken down by water. The resultant sodium sulphide molecule is freely soluble in water, while the sulphide molecule of the other metal is insoluble. The result is an extremely fine (colloidal) suspension of the latter. On the removal of the soluble sulphide (electrolyte) by washing and settling, the colloidal state of the metal sulphide may be made to persist. On the other hand, the continued presence of the electrolyte precipitates metal sulphide gel. May not these properties account for the placing of the sulphide orebodies?

Certain of the double sulphides investigated are truly soluble in water in their entirety; notably iron-sodium, gold-sodium, antimony-sodium, and arsenic-sodium sulphides. May not this fact account for the separate existence of large bodies of auriferous pyrites free from admixture with other base metal? One class of primary ore deposits contains arsenopyrite with a high proportion of antimony sulphide and gold. All the constituents of this ore form truly soluble double sulphides with sodium sulphide.

In the case of these double sulphides, which are soluble in their entirety, precipitation is effected by natural oxidation of the sodium sulphide portion. The solutions

rapidly absorb air and CO_2, sodium sulphide oxidizes to sulphate and carbonate, and the heavy metal sulphide is freed from its soluble combination and is precipitated as a gel by the electrolytes (sulphate and carbonate).

Two classes of primary sulphides are thus defined: first, those which form double sulphides with sodium, which are dissociated by water, leaving the heavy metal sulphides in the form of colloidal sols—e.g., copper, zinc, and lead; second, those which form double sulphides with sodium which are entirely soluble in water—e.g., pyrite; gold; arsenopyrite. (Note—Iron is precipitated from sodium polysulphide as FeS_2 and Fe_2S_3, not as FeS.)

With reference to the gangue matter, usually sulphates and carbonates of calcium, barium and strontium, and more commonly quartz, less commonly siderite (carbonate of iron), the following experiments were conducted:

1. Quartz was fused with sodium sulphide, the mass extracted with water, and the solution filtered. The clear solution was then exposed to the atmosphere in an open beaker. At the end of three weeks, the sodium sulphide in the solution had all oxidized and a large amount of silica gel had precipitated. Occasionally, on repeating this procedure, the silica was deposited in white flakes and massed together in a manner strongly suggesting natural quartz.

2. A gold nugget containing some quartz was fused with sodium sulphide. The whole mass quickly dissolved at a bright red heat. The product was dissolved in water, yielding a yellow solution, which was filtered and allowed to absorb air. Gelatinous silica was deposited with a brown precipitate of gold on its upper surface in fifteen days. In this case, the precipitated silica partly was deposited in the form of semitransparent worm-shaped masses about three inches long and a quarter of an inch thick, strongly resembling a natural quartz formation on a larger scale obtained by the Geological Survey from the Premier mine in British Columbia (osmotic pressure effect).

3. Calcium sulphide was fused with sodium sulphide and the slaggy product extracted with water. The filtered solution was allowed to absorb air, and rapidly developed crusts of sulphate containing some carbonate.

4. Experiment 3 was repeated with barium sulphide. The solution on oxidation rapidly developed crusts of sulphate.

5. A small quantity of ferrous-sodium sulphide was dissolved in water in a dish and exposed to the air overnight. In less than twenty hours the green color of the solution was lost and no trace of sulphide remained. A precipitate of ferric hydrate was obtained from the solution on filtering.

Na_2S Could Account for Certain Vein Fillings

From these observations, I have been convinced that sodium sulphide in its combinations with the alkaline earth metal sulphides, with silica, and with the heavy metal sulphides is a medium which, in conjunction with the action of water, and oxygen in the form of carbon dioxide, could account for the deposition of vein fillings carrying primary sulphides and also for auriferous quartz veins.

In examining this theory, it is natural to seek evidence of the existence of sodium sulphide. The earth's crust and waters contain vast stores of sodium. It is among the most abundant metals and among the most widely diffused. Every rock yields evidence of its presence. It is, therefore, logical to assume that during the cooling of magmas, when the elements are seeking affinities, sodium sulphide and polysulphide would be formed abundantly. So, also, would the sulphides of calcium, barium, and strontium. The alkali and alkaline earth metal sulphides should be included in our considerations of what the geologist calls primary sulphides. It would be difficult, during the long cooling stages, for the heavy metal sulphides to escape contact with sodium sulphide and consequent union as the double sulphides. The subsequent segregation of these double sulphides in the final cooling stages owing to their low melting points, the action of water upon them, and of carbon dioxide, producing plastic gels of vein matter, follows as the inevitable sequence.

Na_2S in Volcanic Lava and Sulphur Deposits

Sodium sulphide in combination with silica, as thiosilicate, has been observed in the lava of Vesuvius. Sodium sulphide has been obtained from the cores in drilling sulphur deposits in the Southern United States; sulphides of lead and zinc occur in the same deposits. The presence of sodium sulphate in many deep springs and mines and large deposits in all parts of the world could be accounted for by the oxidation of primary sodium sulphide. The solubility and readiness to oxidize account for the rare existence of sodium sulphide near the surface today. The easy solubility of sodium sulphate and sodium carbonate, the oxidation products, accounts for the removal of these salts from the vein matter.

Since the notes presented herewith were prepared, I have operated an electric furnace for the manufacture of sodium sulphide, and have constantly observed its behavior at temperatures from 500 deg. to 2,000 deg. C. It is a stable body at temperatures over 800 deg. C. in the presence of water and hydrogen, and in fact may be obtained by reducing sodium sulphate by hydrogen, yielding also water. This shows that it would be free to perform its fluxing action on other sulphides under the conditions of the original rock magma.

In considering the above-enumerated properties of sodium sulphide, it is obvious that polysulphide of sodium would be called upon to function in the same way as monosulphide. It fluxes freely with all other sulphides. Its aqueous solution dissolves ferrous sulphide, and the decomposition of such solution yields sulphides of iron containing more sulphur than FeS—e.g., Fe_2S_3 and FeS_2. Particularly interesting and easy is the preparation of iron sulphide gels of every degree of viscosity from such solutions.

Conclusions

The reactions of the primary sulphides of the alkali metals with those of the alkaline earth metals and with the sulphides of the heavier metals offer an explanation of the mode of formation of primary sulphide ore deposits and of the associated non-metallic minerals.

A rough classification of ore deposits may be built upon the reactions of the double compounds so far investigated:

Nickel Copper Iron	Forming double sulphides with sodium, which are insoluble in, but are slowly broken down by, water, yielding colloidal suspensions of copper and iron sulphides and solutions of sodium sulphide.

Zinc, Lead, Silver, Iron	Forming double sulphides with sodium, which are insoluble in, but rapidly broken down by, water, yielding colloidal suspensions of the heavy metal sulphides and solutions of sodium sulphide.
Gold, Antimony, Arsenic, Iron	Forming double sulphides with sodium which are entirely soluble in water. Precipitation of the heavy metal sulphides is effected by oxidation of the sodium sulphide molecule.

All the above-noted sulphides form double sulphides with sodium, having melting points below 700 deg. C. and (when fused) low viscosities with high specific gravities.

Sulphates and carbonates of the alkaline earth metals, which comprise gangue fillings, can be formed by hydration, carbonation or oxidation of primary sulphides of the alkaline earth metals. The latter are soluble in fused sodium sulphide.

Colloidal silica is readily obtained from solution of sodium thiosilicate ($Na_2S:SiO_2$) by oxidation of the sodium sulphide molecule.

Sodium sulphate results from oxidation of sodium sulphide.

The wide distribution of the sodium, and therefore the possibility of sodium sulphide and polysulphide existing as a primary product in the cooling magma, is my justification for the assumption that these reactions have taken place in the course of formation of primary ore deposits and for my belief that most primary sulphide vein fillings are of colloidal derivation. Differentiations in such fillings are the results of diffusion, osmotic pressure, simple gravity, differential solubility, and many other phenomena which accompany the properties of colloid sols and colloid gels. The reactions of sodium sulphide offer confirmation and are worthy of more extended study. Certainly, the properties of sodium sulphide here discussed seem to signify something more than mere coincidence in connection with both metallic and non-metallic vein filling.

I wish to acknowledge the assistance rendered me from the Honorary Advisory Council for Scientific and Industrial Research in Canada in carrying out this research.

Alkaline Sulphides as Collectors of Metals

By J. E. Spurr

IT HAS LONG BEEN KNOWN and remarked that metal sulphides are soluble in waters containing alkaline sulphides. S. F. Emmons,[1] for example, says: "The metallic sulphides are soluble in waters containing alkaline sulphides or sulphureted hydrogen, and silica and the earthy bases in water containing alkaline carbonates. Solfataric waters (that is, hot waters charged with mineral matter arising from some unknown source below) are known to contain sulphureted hydrogen and the alkaline sulphides and carbonates." And Beyschlag and Vogt[2] write: "With the young gold-silver group, solutions of the sulpho-salts and carbonic acid were the active agents. Where, for instance, an alkaline sulphide is dissolved in a magma, that magma would be capable of taking up arsenic, antimony, bismuth, tin, gold-silver, quicksilver, on the one side, and tellurium and selenium on the other, from a molten mass." And on an earlier page[3]: "The researches of Christy, Le Conte, and Rising, Posepny, Becker and Melville show that at the above-mentioned places (Sulphur Bank, in California, and Steamboat Springs, in Nevada) cinnabar is being precipitated from heated waters wherein it is held in solution by an excess of sodium sulphide, Na_2S. From such a solution precipitation may take place by dilution, by oxidation, by escape of H_2S resulting from the decomposition of Na_2S, by ammonia at a low temperature, or finally by the reducing action of carbureted hydrogen."

Becker's views, above cited, following the experiments of Melville,[4] are based on the discovery that mercuric sulphide is freely soluble in sodium sulphide solutions, doubtless as double sulphides of mercury and sodium of the general formula $HgSNa_2S$. Mercuric sulphide is also soluble in a mixture of sodium sulphide and NaOH and in warm sodium sulphydrate (NaHS). Melville and Becker found that the same reagents would dissolve gold, pyrite, sphalerite, and cupric sulphides; and the easy solubility of sulphides of arsenic and antimony by the same reagents was previously well established.

It is to be remarked, however, that Becker and those who have accepted his conclusions believed that the sodium sulphide was due to the reaction of sodium carbonate and hydrogen sulphide; while, by Mr. Freeman's hypothesis, as set forth in the preceding paper, the reaction is reversed, the sodium sulphide yielding on contact with water and carbon dioxide the sodium carbonate and hydrogen sulphide, according to the following reaction:

$$Na_2S + H_2O + CO_2 = Na_2CO_3 + H_2S$$

"This reaction," Mr. Freeman writes me, "is 100 per cent complete in the presence of carbon dioxide. The colloidal metal sulphide is in most cases unaffected by carbon dioxide."

The well-known paper of Hatschek and Simon on "Gels in Relation to Ore Deposition" was published in 1912, and advanced the view that quartz veins in many instances may have consolidated from gelatinous silica. In the discussion of this paper Mr. H. L. Sulman, a metallurgist who was one of the originators of the flotation process, raised the question of the solvents of the metals in gold-quartz veins. Hatschek and Simon had used gold chloride in their experiments. Mr. Sulman observed[5]:

"It seemed they must look to another class of solution, viz.: to alkaline and other sulphides, as furnishing the likely solvent. Some years ago he found metallic gold to be readily soluble (under certain conditions of temperature and pressure) in solutions of the alkaline sulphides, and especially of the polysulphides; also that under similar conditions ferrous sulphide was also soluble. On dilution, cer-

[1] Mono. XII, U. S. Geol. Surv., Pt. II, 1886, p. 563.
[2] Deposits of the Useful Minerals. Truscott's Translation, 1914, Vol. I, p. 186.
[3] *Op. Cit.*, p. 182.
[4] Mono. XIII, U. S. Geol. Surv., 1888, Ch. XV.
[5] *Trans.* Institution of Mining & Metallurgy, 21st Session, 1911-12, p. 466.

tain of these solutions yielded the characteristic dark bottle-green ferrous sulphide sol. Under such circumstances silica was also soluble; in decrease of pressure and temperature they would thus probably obtain the deposition of a silica gel, accompanied by soluble gold (either as a double sulphide of gold and alkali metal, as sulphide, or as a gold sol) and oftentimes with ferrous sulphide sol; all conditions would here be present for the deposition of gold and pyrites together, without the necessity for importing a reducing hydrocarbon such as methane, as a concomitant to such magmatic solutions. Such a theory would temporarily explain the simultaneous deposition of gold and pyrites in quartz veins."

The experiments of Mr. Freeman detailed in the preceding paper ("The Genesis of Sulphide Ores") were directed toward finding a common solvent for complex ores. Many of these complex ores show practically simultaneous precipitation, together with the gangue: so that he reasoned the solvent must have been one which would dissolve these various metals, differing greatly in their chemical properties, and the silica gangue at the same time. Being a chemist, without the traditions of the geologist, Mr. Freeman found no difficulty in eliminating at the outset water as the universal solvent. In sodium sulphide, however, he did find a solvent which combined with the various metals to form double sulphides which remained fluid at a comparatively low temperature in a dry melt. Thus double sulphides of lead, iron, zinc, copper, nickel, cobalt, manganese, molybdenum, arsenic, antimony, silver, gold, and cadmium were formed, all having melting points below 700 deg. C. Sodium sulphide also fuses with silica and with calcium, barium, and strontium sulphides as well, but apparently at higher melting points, which Mr. Freeman does not specify.

The action of water on a certain group of the double sulphides of sodium and the other metals is to break down the double sulphide, the sodium sulphide going into solution in the water, while the other metal sulphide remains insoluble, resulting in an extremely fine suspension, which may be precipitated as metal sulphide gel. A certain other group of these double sulphides is entirely soluble in water, but may be precipitated by CO_2 or oxygen, whereby the sodium sulphide oxidizes to carbonate and sulphate, and the heavy metal sulphide is precipitated as a gel. In the first-named group are nickel, copper, zinc, lead, silver, and iron; in the last-named group, gold, arsenic, antimony, and iron.

Chemistry May Not Demonstrate Actual Ore History

Chemical experiments, however applicable to geological phenomena, may or may not elucidate actual ore history. The question always is—not what could have happened, but what did actually take place. Therefore I have always contented myself with purely geological reasoning, by which I understand logical inductive reasoning from actual field phenomena; and have accordingly in my thought touched but lightly on chemistry. Certain coincidences from this geological study with the results of Mr. Freeman's chemical studies strike me forcibly. In "The Ore Magmas" I have concluded that a certain group of metals have been dissolved by waters out from the ore magmas proper, and are thus derived from them. These theoretically water-soluble metal sulphides I reasoned to be arsenic, antimony, mercury,[6] and gold[7]: essentially the group defined chemically as water-soluble by Mr. Freeman's experiments. I decided from geologic evidence that these water-soluble metals always precipitated as simple sulphides—stibnite (antimony sulphide), realgar (arsenic sulphide), and cinnabar (mercury sulphide), as distinguished from antimonial and arsenical compounds with copper, lead, and iron (tetrahedrite, jamesonite, and arsenopyrite), which I decided to be characteristic of the ore magmas proper.

Of the ore magmas proper[8] I concluded "All this shows that ore deposition in general is almost independent of water and the gaseous elements, like fluorine, boron, and chlorine, commonly called the 'mineralizers' and often supposed to be great carriers of metal in solution." And on a later page,[9] "In view of the evidence of a very widely varying amount of water and other gases like fluorine, boric acid, etc., while metallic sulphide deposition constantly remains heavy, there is demonstrated the fact that water and these gases, the abundance of which has been long supposed to be the *sine qua non* of ore deposition, are really necessary, if at all, only in very small amounts." Indeed, I reasoned that a certain class of ore magmas were relatively dry.[10]

As to the efficacy of fluorine, a typical "mineralizer," as a solvent, Mr. Freeman observes in a letter:

"I do not think there can be any doubt that in some (comparatively rare) cases fluorine has acted as a solvent for metals, but it certainly could not exist in its solvent form (as free F) in the presence of alkaline solutions, particularly sulphides. Nor is it possible to conceive a general solution of metallic fluorides which would yield mixed sulphides by precipitation: so many metallic fluorides are insoluble. This does not mean that alkaline ore solutions could not contain *inert* fluorides which would diffuse from the crystallizing ore magma along with other salts (sodium carbonate, etc.) into the wall rocks."

Conclusions Coincide in Various Ways

Mr. Freeman's chemical conclusions and my own geological conclusions then coincide in various ways:

1. That water was not the universal solvent for the ore magmas and, indeed, was not the agent which concentrated the metals from the rock magma.

2. That the so-called mineralizers, like fluorine and boron, were likewise not capable of the chief rôle of dissolving metals and extracting them from the rock magma. Neither water nor the other gases were the essential extractors or the carriers.

3. Water, however, is present in most ore magmas (as well as in rock magmas), and arsenic, antimony, and gold have gone into aqueous solutions, but not copper, lead, zinc, and silver, which remain in gelatinous sulphide form in the presence of water.

4. I have noted[11] that in the normal zonal sequence of metals as found in nature, copper, lead, and zinc occur to an important degree only at one temperature each; while gold, arsenic, and antimony, as well as iron, appear at various temperature zones—gold having apparently three distinct temperature zones, ranging from relatively high to low temperature, and arsenic and antimony occurring at intervals throughout much of the temperature range. Iron also occurs throughout the whole range of temperature.[12] This is well explained by Mr. Freeman's grouping of these four metals as forming, with sodium, double sulphides which are entirely soluble in water.

Granting that these coincidences alike bolster up the

[6] "The Ore Magmas," Vol. II, pp. 544, 795, 796, 811, 812, 824, 825, 826, 828, 832.
[7] *Op. cit.*, Vol. II, pp. 300, 441, 699, 700, 701, 705, 778.
[8] *Op. cit.*, p. 620.
[9] *Op. cit.*, p. 625.
[10] *Op. cit.*, pp. 321, 324, 618, 619.
[11] *Op. cit.*, p. 615.
[12] *Op. cit.*, pp. 807-811.

conclusions as to ore magmas to which I have come; and, on the other hand, Mr. Freeman's theory that alkaline sulphides constitute the chief solvent which has extracted the metals, together with their gangues, from the mother rock magma, and thus produced the segregation of the ore magmas, many points yet remain to be cleared up. The temperature of fusion of Mr. Freeman's double sulphides of copper, lead, and zinc are as follows: copper, 560 deg. C.; zinc, 620 deg.; lead, 650 deg., copper being the lowest and lead the highest. The temperature of precipitation of these sulphides in nature has the same sequence, but reversed, as is proven by the illustration of the Zonal Theory: copper in nature is precipitated at the highest temperature, zinc next, and lead the lowest. Moreover, this whole range of temperatures of Mr. Freeman's experiments is probably higher than the corresponding freezing temperatures of the ore magmas in nature, which are with excellent reason all regarded as below 575 deg. C.[13] and probably below 500 deg.[14]

In this connection Mr. Freeman writes that potassium sulphide, which would certainly be present, would reduce the melting point of the double metallic sulphides and that silica and particularly free sulphur would operate in the same way. The range of temperature given—90 deg. C. in the copper-zinc-lead sequence of Mr. Freeman—is close to that which I have assumed in nature.[15] Concerning the sequence and the temperatures, however, the evidence of the presence of some water in a large proportion of ore magmas indicates that the actual ore precipitation is not directly from the double sulphide stage, accepting Mr. Freeman's theory, but from the gelatinous metal sulphide stage into which the double sulphides are transformed by the action of water.[16] Nevertheless, the lack of stibnite and realgar stages in many regions of metal deposition where antimony and arsenic are abundant (combined with the stable metals like copper, lead and silver), and the areal restrictions of important deposits of stibnite and cinnabar (and realgar), would seem to indicate that the highly aqueous ore magma was the exception.

Cleaning a Stone Building with Steam

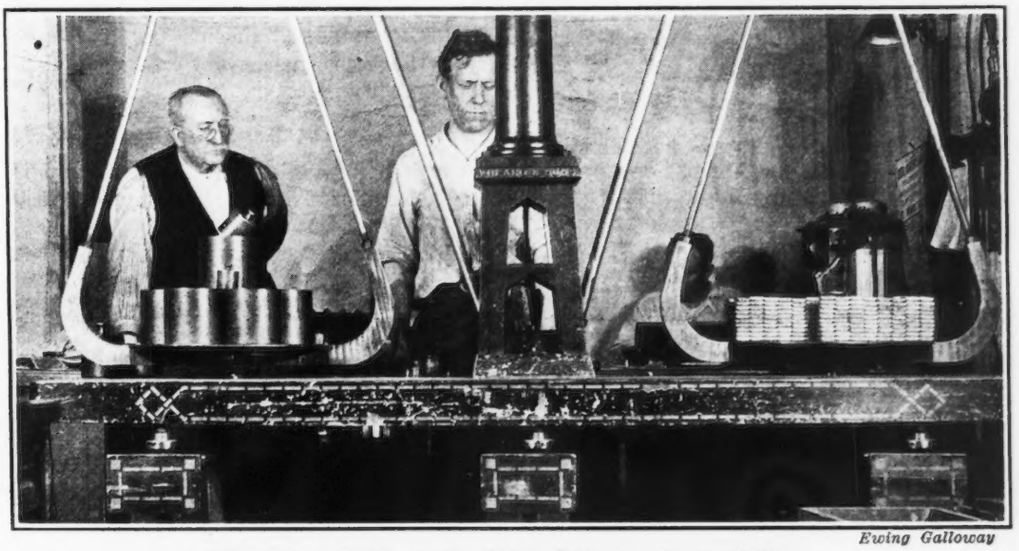
The use of steam from a boiler blown directly against the stone through a simple nozzle has been found by the Bureau of Standards, of the U. S. Department of Commerce, to be a very effective way to remove dirt from the walls of a stone building. An interesting demonstration of this experimental work was the steam cleaning of a remodeled bank building in Baltimore, Md., where the method was given a practical trial under commercial conditions. The use of steam at 80 lb. per square inch pressure blown directly against the stone through simple nozzles made of galvanized pipe fitted to the end of ½-in. steam hose lines was found to be effective in removing the twenty-year accumulation of dirt on this Indiana limestone building. Although the structure was heavily carved and molded, the work was done rapidly with inexperienced labor, the engineer firing the boiler being the only skilled worker that was employed on the job.

[13] *Op. cit.*, p. 836.

[14] *Op. cit.*, pp. 637, 660.

[15] "The Ore Magmas"; also "Basic Dike Injections in Magmatic Vein Sequences." Bulletin Geological Society of America, December meeting, 1924.

[16] Concerning the arrangement of ores according to my Zonal Theory, Mr. Freeman writes me under date of Nov. 12, 1925: "While zonal arrangement may depend largely on temperature and the manner of segregation of cooling mixed sulphide eutectics, it is much more clearly explained to me by the physical behavior of the various double sulphides with water. Thus, repeated laboratory experiments show that copper sodium sulphide does not disintegrate in water—it allows the sodium to diffuse out and retains its outward shape, but as a non-flowing colloidal mass. This is true even when much iron sulphide is present. Zinc sodium sulphide is more readily broken down by water and is quite different from either copper or lead. It yields thick slimy pastes. Now, lead sodium sulphide is more rapidly broken down and yields free-flowing suspensions of lead sulphide hampered only by the higher gravity of lead. Thus, the tendency of copper would be to remain 'close to home' and the zinc would travel more readily. Zinc and lead are more alike in their ability to transport as sulphide after the removal of the sodium and are more or less together. Now, iron sodium sulphide when attacked by water is partly dissolved and partly precipitated. It therefore can travel farther, but is also found in all other sulphides. Arsenic and antimony and gold are much more truly soluble than iron (that is, in greater concentration), and therefore they can travel farthest from the magmatic source. The water to cause these decompositions may or may not be derived from within the magma. Of course with all metal sulphides a large excess of sodium sulphide will give products which will break down to flowing colloidal suspensions readily, but I have found that copper requires the largest excess and zinc, lead, iron, arsenic, antimony the smallest in the order given. However, if to a melt containing a large excess of sodium sulphide a quantity of silica be added, then the latter takes up the excess of sodium, forming $Na_2S:SiO_3$ and leaves the approximate pure double sulphide of the metal as a free fused mass below the more viscous thiosilicate. I have done this repeatedly in the electric furnace and regard it as proof positive that the double sulphides only have to be dealt with in consideration of the theory. To sum up, therefore, I would attribute zonal arrangement largely to the physical properties of the sulphide after removal of the sodium by water, these properties affecting transportability in the following order: copper, zinc, lead, iron, arsenic, antimony, gold."



Ewing Galloway

Weighing Gold at the United States Assay Office

The New Revenue Bill

What the Ways and Means Committee of the House Proposes Shall Be Done About Federal Taxes

By Robert Murray Haig
School of Business, Columbia University

Robert Murray Haig

IT WILL be recalled that the Revenue Act of 1924, with its maximum surtax rate of 40 per cent, made President Coolidge very unhappy. In signing the bill he stated plainly that he would urge a new act at the earliest possible moment. A Treasury surplus of more than a quarter of a billion dollars for the year ended June 30, 1925, made a new act inevitable. Instead of summoning a special session of Congress, however, the plan was tried of calling the Ways and Means Committee to Washington in October to frame a bill to be rushed through Congress before the income tax returns would fall due in March, 1926. On Dec. 5, the Ways and Means Committee made public the first draft of the new Revenue Act of 1926. This was introduced in the House at the very opening of the session, and there is every reason to believe that it will be sent to the Senate before Christmas without substantial alterations.

What will happen in the Senate, no one can foretell. In the draft as it now stands, although called the "Revenue Act of 1926," Title II, covering the income tax, is made effective as of Jan. 1, 1925. This means not only that the new rates would apply to the income for the current year, 1925, but also that the new rules for computing taxable income will apply in making up the returns covering that year, due next March. It seems highly probable that the Senate will change little in the bill except perhaps the rates and that some time in February the new act will go to the President for his signature.

On the other hand, the Senators may seize this opportunity to prove to their presiding officer that their inclination toward protracted deliberation has not been affected by his campaign against the rules permitting unlimited debate. They would be wise, however, to choose some more innocuous measure for this demonstration. The Treasury suggestions for technical changes in the wording of the statute have been incorporated in the house draft, and the act as finally placed on the statute books will almost certainly be very much like the Ways and Means Committee draft now under consideration.

In an article published in this journal about a year ago I expressed the hope that, when this new revenue act came to be written, Congress would confine its activities to modifications of the rates, leaving the structure of the income tax unchanged. Happily, an examination of the bill introduced by the Ways and Means Committee shows that the changes in the law, aside from the adjustment of the rates, are few indeed.

The House bill proposes to reduce taxes by approximately $325,000,000, nearly $200,000,000 of this amount representing cuts in the income tax and about $125,000,000 cuts in other internal taxes. It is not proposed to discuss here the general question of the wisdom of drastic tax reduction, compared with rapid debt reduction. The country seems to be convinced that tax reduction is what it wants, and Congress is inclined to defer to its wishes.

Reduction in Rates

The rate on corporations remains unchanged at 12½ per cent. The normal rates on individual incomes are made 1½ per cent on the first $4,000, 3 per cent on the next $4,000, and 5 per cent on the remainder. The present rates are 2, 4, and 6 per cent. The surtaxes are unchanged in the lower ranges. After the income reaches the $44,000 mark, however, the surtax rates rise much more slowly than in the present law. At the $100,000 mark, under the present law, they reach 37 per cent and touch 40 per cent at $500,000. Under the bill, the maximum rate of 20 per cent is reached at $100,000.

The retention of the corporate rate at 12½ per cent and the reduction of the normal rate to a maximum of 5 per cent increases still further the discrimination against the corporate form of organization, while, at the same time, the reduction in the surtaxes reduces the advantage attaching to the corporate form by virtue of the possibility of retaining earnings in the business without subjecting them to surtaxes. It is a question as to how much further this discrimination can be pushed without stimulating large numbers of corporations to reorganize as partnerships. As it stands, the federal income tax has become in fact a heavy business income tax on corporations as well as a personal income tax.

Increase in Personal Exemption

The single man's personal exemption is raised from $1,000 to $1,500 and the exemption of the head of a family, from $2,500 to $3,500. This will result in relieving entirely from taxation a large number of persons now subject to tax, perhaps as many as a million and a quarter. The wisdom of this seems doubtful. Secretary Mellon estimates that the cost of collecting about $167,000,000 from taxpayers with incomes below $5,000 does not exceed $5,000,000. Already the American exemptions are far above those in foreign countries. Furthermore, there is much to be said against restricting the income tax to the rich. The moderately well-off should pay some direct tax to the federal treasury.

At present, the maximum amount of income which may be classed as "earned" for purposes of the 25 per cent credit is $10,000. The bill raises this figure to

$20,000. Moreover, whereas the present law does not permit the earned income credit in any case to exceed 25 per cent of the normal tax the person would otherwise be called upon to pay, the bill adds to that limit 25 per cent of the surtaxes which would be payable if his earned income constituted his total income. At present, the greatest reduction one can possibly secure as the result of the earned income credit is $90. Under the bill this maximum is raised to $250.

Effect of Changes in Rates, Exemptions and Credits

The net effect of the proposed changes in rates, personal exemptions and earned income credit for a number of typical incomes is shown in the accompanying table. The $5,000 man is relieved of practically his entire tax. The tax of both the $10,000 man and the multi-millionaire is cut nearly in half. The reduction granted the $25,000 man and the $100,000 man amount to about one-fourth of their present taxes, whereas the $50,000 man gets a reduction of only 12 per cent.

In other words, the $200,000,000 reduction in income taxes under the proposed bill is to go largely to those with relatively small and relatively large incomes. Those in the middle ranges find few gifts from the Ways and Means Committee in their Christmas stockings. Those with incomes of less than $25,000 and those with incomes in excess of $100,000 are to receive cuts ranging well above 25 per cent. Moreover, reasoning from the 1924 statistics of income, the latest available, the very rich group with incomes in excess of $100,000 are due to receive about twice as much of the $200,000,000 tax reduction as the "poor" group, those with incomes of less than $25,000.[1]

Reduction in Income Taxes Under House Bill

Assumptions: Taxpayer is married, with two children under eighteen years of age. His income in each case is 80 per cent salary, 10 per cent dividends, and 10 per cent interest, fully taxable.

Man's Income	Income Tax Under Present Law	Income Tax Under House Bill	Reduction	
			Amount	Per Cent
$5,000	$18	$2.25	$15.75	87
10,000	121	67.13	53.87	45
25,000	1,375	1,003.75	371.25	27
50,000	5,755	5,078.75	676.25	12
100,000	21,935	16,228.75	5,706.25	26
500,000	196,535	114,228.75	82,306.25	42

Income Tax Changes of Particular Interest to the Mining Industry

Depletion deductions based on discovery value are specifically eliminated as items reducing the base from which gains or losses are measured. The present law contains merely a general statement to the effect that in computing gain or loss "proper adjustment shall be made for . . . any items of . . . exhaustion, wear and tear, obsolescence, amortization or depletion, previously allowed with respect to such property." The proposed new provision reads:

"Sec. 202(a). The basis shall be diminished by the amount of the deductions for exhaustion, wear and tear, obsolescence, amortization, and depletion which have since the acquisition of the property been allowable in respect of such property under this Act or prior income tax laws: *but in no case shall the amount of the diminution in respect of depletion exceed a depletion deduction computed without reference to discovery value. In addition, if the property was acquired before March 1, 1913, the basis (if other than the fair market value as of March 1, 1913) shall be diminished in the amount of exhaustion, wear and tear, obsolescence, and depletion actually sustained before such date.*"

Again, the "discovery value" section is entirely rewritten so as to define much more precisely than is done in the present law what shall be considered to be a "proven" tract or lease. The proposed new section reads:

"Sec. 204(c). (1) *In case of oil and gas wells discovered by the taxpayer after February 28, 1913, and prior to January 1, 1925, and in the case of mines discovered by the taxpayer after February 28, 1913, the basis for depletion shall be the fair market value of the property at the date of discovery or within thirty days thereafter, if such wells and mines were not acquired as the result of the purchase of a proven tract or lease, and if the fair market value of the property is materially disproportionate to the cost;*

(2) *In the case of oil and gas wells discovered by the taxpayer on or after January 1, 1925, in an area not proven at the date of such discovery, where the fair market value of the property is materially disproportionate to the cost, the basis for depletion shall be the fair market value at the date of discovery or within thirty days thereafter of the property proven by such discovery and included within the taxpayer's tracts or leases. In the case of oil or gas wells, each well producing oil or gas in commercial quantities shall be considered as having proven at least that portion of the productive sand, zone, or reservoir which is included in a square surface area of 160 acres, having as its center the mouth of such well. In the case of the discovery of an oil or gas well by a person under an agreement whereby the cost of the well shall be shared with one or more other persons or whereby the cost of the well shall, if oil and gas in commercial quantities is not found, be shared with such other person or persons, then such well shall not be considered as having proven any part of a tractor lease held by such other person or persons.*"

In explanation of these amendments the report of the Committee on Ways and Means makes the following statement:

"The committee feels that the deduction for discovery depletion should be limited somewhat further than it was limited in the Revenue Act of 1924, and in addition that there should be incorporated in the act the Treasury regulation defining a proven area. Under the existing law, discovery depletion is allowable to one who brings in a well upon property proven at the time the well is brought in, if at the time it was purchased by the taxpayer it was not proven. Obviously the benefits of discovery depletion, the purpose of which was to encourage the wildcatter or pioneer, should be limited to those who make an actual discovery. Furthermore, in the interest of certainty and clarity it is thought advisable to incorporate in the law a definition of what is a proven area. With these two objects in mind the committee recommends the amendments of the discovery provision contained in the bill."

Nothing is proposed in the new bill to change the situation under Section 201(d) whereby mines, *but not oil and gas wells*, are permitted special treatment for distributions from depletion reserves based on discovery value.

Miscellaneous Income Tax Changes

At present all interest paid may be deducted by an individual, except such as is paid on money borrowed to purchase or carry certain tax-exempt bonds. The House bill adopts one of the old Mellon plan suggestions when it proposed that an individual shall be allowed

[1] In 1924 the taxpayers with incomes of over $100,000 paid $300,196,512, compared with the $144,169,043 paid by those with incomes under $25,000.

to deduct interest paid, unless in connection with his business, only to the extent that such interest exceeds the interest received from tax-exempt securities.

A change of doubtful merit is that which, within certain limitations, exempts from taxation the salaries and commissions of citizens selling United States goods abroad. It would seem that the situation which this clause is designed to meet could be cared for better by a special credit of any foreign taxes to which the salesman might be subjected.

The gift tax is scheduled for repeal, as is also the provision requiring publicity of the taxes paid by the various persons subject to the income tax.

The Board of Tax Appeals is strengthened by increasing the number of members, increasing the salaries, and making the terms of office indefinite.

Extensive changes are seen in the technical sections governing appeals, deficiencies, credits, refunds, etc., but these are of too little general interest to call for description here.

Changes in Other Internal Revenue Taxes

In spite of the strong pressure to resign inheritance taxation to the states, the committee has recommended that the federal estate tax be continued with rates reduced from a maximum of 40 per cent to a maximum of 20 per cent and with the credit for such taxes paid to the states increased from 25 per cent to 80 per cent. It is wise, in my opinion, for the federal government to continue death duties to this extent, at least, until the states demonstrate their ability to solve the problem of double taxation and their willingness to avoid competing for the favor of taxpayers through exemptions from death duties, after the manner of Florida.

The availability of approximately $125,000,000 for the reduction of the miscellaneous taxes has made it possible to slash heavily. The list of "nuisance" and "luxury" taxes is, in fact, almost eliminated in the House bill. No longer will the federal government tax shooting galleries and mah-jongg sets, slot machines and pool tables. The various special taxes on automobiles are greatly reduced, the proposed cut, according to the estimates, amounting to $85,650,000. The tax on cigars is reduced appreciably, but not that on cigarettes and other types of tobacco products, which, under the proposed new arrangement, are counted on to supply more than half the total internal revenue receipts, other than income and estates taxes. Even the admissions tax is eliminated in the case of tickets to the "legitimate spoken drama," which is now officially defined in the law in rather amusing terms.

When the financial history of this period is written, the Revenue Act of 1926 will probably be recognized as marking the last of the series of great tax-reduction measures. With the passage of this bill the big cuts in federal taxes are probably ended for this generation unless something can be done about war! The President in his budget message warns that expenditures have now been cut to the limit. In view of this, one of the most interesting of the House proposals is the establishment of a "Joint Commission on Taxation to investigate and report upon the operation, effects, and administration of the federal system of . . . . taxes." This commission, if established, will have a remarkable opportunity to influence for good the character of federal taxation during the next few decades. To such a group the country might look for a practicable plan for articulating the corporation tax and the capital stock tax with the personal income tax, a reasonable program for improving the administration of the law and for wise guidance regarding the character and the rates of the income tax and other internal revenue measures. Based on the work of such a commission, the Revenue Act of 1928 should be an interesting document indeed.

New Bulletin on Magnesite in California

California was for many years the sole domestic source of magnesite production in the United States, and still leads, although now joining in commercial output by the State of Washington. During the period of the World War, 1914-1918, and subsequently, the availability of American supplies became of vital importance and California was not found wanting.

Before the war, nearly all the magnesite used for refractory purposes in the United States was imported. It was used as lining for basic steel furnaces and converters, and in other melting and heating furnaces in metallurgical works.

Because of the present increasing importance of the domestic magnesite industry and the active demand for data and information on California's resources, the State Mining Bureau, under direction of Lloyd L. Root, State Mineralogist, has just issued a comprehensive and detailed report, entitled "Magnesite in California," as Bulletin No. 79, with Walter W. Bradley, Deputy State Mineralogist, as the author. In addition to descriptions of the mines and plants, detailed information is given on properties, varieties, and uses of magnesite and its products; also specifications and testing for oxychloride cement mixtures.

The bulletin is cloth bound, contains 147 pages, and is profusely illustrated with sixty-two half-tone plates and eleven line-cut drawings (including maps). It may be obtained for $1, postpaid, from the State Mining Bureau, Ferry Building, San Francisco.

A California Oil Well

Dr. Frederick P. Vickery, of the Southern Branch of the University of California, says *Science*, Oct. 23, 1925, writes that on Sept. 25, the Miley Oil Co.'s No. 6 well, located at Athens, Los Angeles County, Calif., reached the climax of a career of record breaking by becoming a producing well at a depth of 7,591 ft.

Some of the records established by this well are as follows: (1) Depth 7,591 ft., the deepest hole ever drilled, as well as (2) deepest oil well in the world. (3) Landed 4¾-in., No. 15, casing at 7,591 ft., the longest string of pipe ever set. (4) Cemented 4¾-in. casing through perforations at 7,305, the deepest cement job ever attempted. (5) Took formation cores from depth of 7,570 ft. and recovered perfect samples of good oil sand.

The well was drilled with rotary tools in a total of 230 working days, an average of 33 ft. per day. The total cost of drilling, including labor, material and overhead, was $164,000, or $21.60 per foot.

The following casing was set: 15½-in., No. 70, cemented at 988 ft.; 8¼-in., No. 36, cemented at 5,289 ft.; 4¾-in., No. 15, landed at 7,591 ft. and cemented through perforations at 7,305 ft.

The well is producing about 150 bbl. of 37 deg. Bé. gravity oil per day with 20 per cent of salt water. A gas lift is used to make the well flow, as pumping was considered impracticable on account of the depth.

Discussion

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

Atomic Structure and Flotation

THE EDITOR:

Sir—The discussion relative to the subject of atomic structure and flotation, which has appeared in your Oct. 10, Oct. 24 and Nov. 7 issues, has been of considerable interest to me as a student of atomic structure. Mr. McLachlan has failed to satisfy me with regard to the connection between atomic structure or crystal lattice structure and the phenomena of flotation.

In the case of the metallic sulphides I should think that the following statements by Mr. McLachlan published in the Nov. 7 issue would make it obvious that his paper has failed to show the existence of any relation between the lattice structure and the floatability: "In my article, the statement is made that 'sulphur and the metals have an affinity for oxygen and therefore so will the surfaces which they form.' Such being the case, it is immaterial, so far as the metallic sulphides are concerned, whether they fracture along a crystal surface or not, for whatever surface is formed when they are broken, that surface must have an affinity for oxygen." If this is the case where is the connection between the crystal structure of metallic sulphides and their ability to float?

Passing to minerals such as $CaCO_3$, SiO_2 and CuO, which are non-floatable, he considers that a surface containing only metal atoms has its attractive forces for the oxygen of the froth compensated by a modifying influence of the oxygen atoms lying immediately within such surfaces. The question of distance over which the attractive forces (orienting power) of an atom can extend and residual valence is raised and reference is made to the work of Dr. Langmuir on the subject. Dr. Langmuir has himself applied his own theories discussed in the earlier paper cited by Mr. McLachlan, to the mechanism of the surface phenomena of flotation. (*General Electric Review*, Dec. 1921 pp. 1025-1033.) Mr. McLachlan apparently has not encountered this later paper.

It is apparent that the phenomena treated by Mr. McLachlan can not be considered as simple as he would indicate and there are many important factors entering into the problem. In fact, this is the conclusion obtained by Dr. Langmuir by application of the identical theoretical principles to the phenomena of flotation which were cited by Mr. McLachlan in support of his explanation of the non-floatability of the metallic oxides. Statements such as the following, from the discussion of experimental results by Dr. Langmuir, indicate that the explanation is no simple one: "This result seems to be inconsistent with the theory of surface tension discussed in the early part of this paper according to which the surface tension depends only on the nature of an arrangement of the atoms forming the actual surface."

I believe from Dr. Langmuir's work that the influence of oxygen atoms not in the actual surface have been taken into consideration. While I agree with Mr. McLachlan that this factor is an important one, other factors also enter into the case, one of which, according to Dr. Langmuir, is the contact angle formed between the oily surface of the bubble and the contaminated surface of the solid. "The results indicate that the selective action by which substances like galena are separated from quartz and calcite is dependent upon the contact angle formed by the oiled surfaces rather than by any selective tendency for the oil to be taken up by some minerals more than by others." For further details consult the paper by Dr. Langmuir cited above.

Experimental work such as that by Dr. Langmuir and the very recent work of Messrs. Tucker and Head (preprint No. 1487-B issued with *Mining and Metallurgy)* may eventually lead to a solution of the problem. We must at present, however, continue to recognize that the problem of the mechanism of flotation remains a very healthy one. ERNEST E. FAIRBANKS.

Reno, Nev.

Idaho Copper Co., Ltd., Entirely Different From Idaho Copper Corporation

THE EDITOR:

Sir—Duplicates of the following letter have been sent to the president, San Francisco Stock Exchange; the chairman of the listing committee, San Francisco Stock Exchange; to the president, Los Angeles Stock Exchange; and to the chairman of the listing committee of the Los Angeles Stock Exchange:

"We have been informed that the 'Idaho Copper Corporation,' a Delaware corporation, either has applied or is about to apply to your exchange for listing. We feel it our duty to advise you at this time that we have brought suit in the Federal Court at Boise, Idaho, to permanently enjoin this 'Idaho Copper Corporation' from the use of this name that is so similar to our own and which is causing great confusion where our company, our personnel, and our properties are known. Our attorneys inform us that they believe this injunction will undoubtedly be granted.

"This 'Idaho Copper Corporation' purports to own three mining claims in the same general Idaho district as our own Red Ledge properties. After investigation, we are unable to learn that their three claims have any mineral value.

"This 'Idaho Copper Corporation' has been the subject of formal complaint by the mining authorities of the State of Idaho, and if additional information both as to that company's properties and personnel is required, it is suggested that inquiry be directed to any public official of the State Capitol in Boise, Idaho.

"Mr. George Graham Rice, we are informed, is the name of the individual guiding the promotion of this 'Idaho Copper Corporation.'

"IDAHO COPPER COMPANY, LIMITED,
"By O. H. Griggs, president."

Andalusite in California

THE EDITOR:

Sir—Mr. John Melhase's letter, "Andalusite and the Geologist," published in your Nov. 21 issue, came to me as a surprise. I am very grateful to Mr. Melhase for his interest, particularly as he is not only a disinterested party but also a geologist, with first-hand information regarding the mine of the Champion Porcelain Co., which he visited quite recently.

I am sure Mr. Melhase's letter will do much to clear up any misunderstanding, or false impressions, which may have arisen from Dr. Adolph Knopf's letter printed in your Nov. 14 issue, and which implies that we are seeking the credit for the discovery of andalusite in California. Please understand that it is our desire that he receive full credit. In fact, if it had not been for his publication, it is quite likely that our intensive search would have been continued in South Dakota, rather than transferred to California.

In my letter to you published in the Oct. 4 issue I inadvertently referred to the U. S. Geological Survey Professional Paper 110, by Dr. Knopf, instead of his article in the *Journal* of the Washington Academy of Sciences, Nov. 4, 1917. This article, entitled "An Andalusite Mass in the Pre-Cambrian of the Inyo Range, California," was called to my attention by the U. S. Geological Survey of Washington, D. C., under date of Jan. 15, 1919, in answer to an inquiry of mine for possible sources of andalusite.

Contrary to Dr. Knopf's assertions, considerable difficulty was experienced in finding the andalusite mass referred to in his article. No accurate description of its location was given, and I was not so fortunate as Dr. Knopf to have someone to lead me directly to the mass he discovered, the trail referred to by him having been destroyed by unprecedented cloudbursts, said to have occurred in 1917,

There seems to be some doubt, after reading Dr. Knopf's letter, that he fully realizes the location of our mine. The two deposits are over a mile apart, and if he had carefully observed the frontispiece of the July 18, 1925, issue of the *Mining Journal-Press* and Mr. John Melhase's article in the same issue, he might have omitted some of the caustic remarks in his letter, for this photograph is the east wall of a huge cliff on the north side of Dry Creek Canyon, instead of the west wall of the andalusite mass on the south side of Dry Creek, described by Dr. Knopf in his article published in the *Journal* of the Washington Academy of Sciences.

Inasmuch as the andalusite mine of the Champion Porcelain Co. is situated over a mile distant and at an elevation nearly 2,000 ft. above Dr. Knopf's deposit, we still feel that we are entitled to the credit for its discovery. JOSEPH A. JEFFERY,

President, Champion Porcelain Co.

Detroit, Mich.

Securing Government Publications

THE EDITOR:

Sir—I have just read your editorial "Paying for Government Documents" in the Dec. 5 issue. Your presentment of the matter interested me very much, but permit me to present another side of the case.

To some persons it is important, if not necessary, to receive these preliminary chapters of the "Mineral Resources" as soon as possible. As it is, it takes the government a long time to prepare them, so that they are usually a year behind, if not more.

To have a standing order eliminates much time and trouble. New publications of the government are listed once a month by the issuing department and by the Superintendent of Documents, the latter about two months later than the first. These have to be carefully read, checked, and each item ordered by letter with the proper amount of money in coupons inclosed. A follow-up is kept and the documents may be received any time between ten days to three weeks after they are ordered. Not only is this delay serious at times, but these preliminary chapters in particular are only tentative, and after the set has been completed they are published in book form at $1 per volume, there being two volumes every year. "Mineral Resources" for 1922, part 2, is only just published.

We order $10 worth of coupons at once. The Patent Office also issues coupons, but this office, as well as the Library of Congress, permits a sum to be deposited against which accounts may be drawn. The Superintendent of Documents should have a similar plan.

The Government Printing Office is the largest printing plant in the world, and no doubt the Superintendent of Documents is suffering, as so many other government departments are suffering, from lack of sufficient help and a staff much too small for the demands made upon it. The press would be conferring a benefit upon the public if it would urge Congress to remedy conditions in an office of the importance of the Government Printing Office, so that we may depend upon good service from it. ESTELLE L. LIEBMANN, Librarian,

Technical Library, E. I. du Pont de Nemours & Co.,

Wilmington, Del.

Asbestos Screen Tests

THE EDITOR:

Sir—In the article, "Asbestos in Arizona," on page 809 of the issue of *Mining Journal-Press* of Nov. 21, I notice that in the table of Comparison of Tests the "Association Screen Tests" are out of line. The error is that you show under the first column, "Screen Test Crude No. 1—Average 1 in.," and then you show "Operators' Grade Mill 2 B," and "Association Screen Test, 4-7-4-1." People are led to believe that Crude No. 1 is called "Mill 2-B," and that there is a test thereon. Likewise for Crude No. 2, you show "Screen Test, Average ½ in.," and then you show "Operators' Grade" as "Mill X," and the test "0-8-6-2."

The correct way in my opinion is as follows:

Dealer's Catalog Grade	Screen Test	Operators' Grade	Association Screen Test
Crude No. 1	Average 1 in.		
Crude No. 2	Average ½ in.		
Long Spinning Fibre	2-9-4-1	Mill 2B	4-7-4-1
Short Spinning Fibre	0-8-6-2	Mill X	0-8-6-2
Magnesia and Compressed Sheet Fibre	0-6-6-4	No. 1	0-2-10-4
Shingle Stock	0-1½-9½-5	No. 2	0-1½-9½-5
Paper Stock	0-0-10-6	No. 1	0-0-9-7 or 0-0-10-6
Cement Stock	0-0-6-10	No. 2	0-0-6-10
Floats	0-0-0-16		

Furthermore, cement stock does not test 0-0-6-10, but, as a rule, 0-0-5-11.

The way the article as printed reads is rather complicated, and even I, with many years' experience, could not for some time straighten the matter out. You also show No. 1 paper stock as testing 0-0-9-7, a screen test which is very seldom used. The actual tests for paper stock are either 0-0-11-5 or 0-0-10-6. B. MARCUSE,

Asbestos Crude and Fibre Corporation.

New York City.

News of the Week

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

RECOMMENDATIONS of the Advisory Committee of the Bureau of Mines adopted; extent of rescue work still undecided; shortage of space to house various groups in one building.

November shipments of Michigan copper, 15,820,000 lb.; Calumet & Hecla to take over mineral range railroad; Seneca makes regular shipments.

New Jersey mineral production $81,500,000 per year, pottery products being first and brick and tile second in importance.

Bethlehem Shipbuilding Corporation plans shale-oil plant at Santa Maria, Calif.

Alaska Juneau mills 305,000 tons in November; recovery $192,000; profit 12.04c. per ton.

Ontario wins suit for extension of railway into Quebec; Amulet to extend drilling program; freight rates on explosives lowered; new ore discovered by Nipissing, Crown Reserve and Vipond.

Duthie mines in British Columbia make regular shipments; Federal M. & S. Company bonds Li-Li-Kel claims, near Blackwater, B. C.; Porcupine Goldfields takes lease and option on Galena Farm mine.

Helium rights in Peel County, Ontario, purchased by the provincial government.

Mining officials have confidence in President Calles of Mexico.

New Cornelia earnings pay off indebtedness; Cochise County, Ariz., has low-accident record for year.

November Shipments of Michigan Copper, 15,820,000 Lb.

Calumet & Hecla to Take Over Mineral Range Railroad—Champion Yield, 43.88 Lb. per Ton of Rock

Copper shipments by boat out of the Michigan district in November were 12,422,000 lb. Calumet & Hecla Consolidated and Isle Royale shipped 9,144,000 lb.; Copper Range and Mohawk, 2,802,000 lb.; and Quincy, 476,000 lb. In addition, approximately 3,400,000 lb. moved by rail, bringing the total up to 15,822,000 lb. or about 2,000,000 lb. more than actual mine production for the month. The Michigan companies will finish the year with no unsold refined surplus.

Calumet & Hecla Consolidated has received the electric hoist which will serve No. 4 Calumet shaft in the haulage tunnel of the conglomerate department. The hoist for No. 7 Hecla shaft will be delivered soon. It will require two months to install these hoists. They are single-drum, 6-ft. diameter hoists, designed to withstand moisture and to meet the physical conditions of the hoists locations.

Calumet & Hecla Consolidated will soon take over the Mineral Range railroad main line tracks extending north of Kearsarge, which will become part of the new Ahmeek railroad system serving all of the Kearsarge lode properties. Spur lines into shafthouses were previously taken over. Tracks near the Ahmeek and Tamarack stamp mills at Torch Lake will be included in the new transfer. Output from the Ahmeek mine is 3,600 tons per day.

Copper Range is successfully handling the excessive flow of water into Champion No. 4 shaft. The flow is at the rate of 2,100 gallons per minute.

Values in Baltic and Trimountain show no diminution, although Champion at depth is not quite as rich as in the upper levels. Champion last year obtained an average yield of 43.88 lb. of refined copper per ton, the highest in the property's history.

Swansea Gold and Copper Mining Co. Protests Permit for Abandonment of Railroad

PROTESTING that the corporation commission was without jurisdiction in granting the Arizona Swansea Railroad Co. permission to abandon its line from Bouse to Swansea, the Swansea Gold and Copper Mining Co. has applied to the commission for a rehearing of the matter.

The order authorizing the company to cease the operation of its road and to dismantle its track and abandon its train service on the line was issued by the commission some time ago, following a hearing of an application of the railroad company for permission to abandon its operations.

Discovery of Mercury at Cripple Creek, Reported

Reports are current that mercury in commercial quantities has been found at a depth of 1,500 ft. in the Dante mine, Verner Z. Reed estate, in the Cripple Creek district of Colo. If true, this should give Cripple Creek a new lease of life.

Cochise County, Ariz., Has Low Accident Record

Only Two Fatalities During Year—Missed Holes 5 in 1,000 Shots—Employees 87 per Cent Citizens

The annual report of the State Mine Inspector for Arizona for the year ending Nov. 30, 1925, shows that Cochise County has made the best accident record for that part of the state in a number of years. Approximately 3,000 men are employed by the mining companies of the county, and only two fatal accidents have occurred, both on small properties. The Calumet & Arizona Mining Co. has not had a fatal accident since Sept. 10, 1923, and no one has been killed in the Copper Queen workings in the last fourteen months. The two most serious non-fatal accidents were the loss of a foot and the probable loss of an eye. Accidents charged to handling explosives in past years were numerous, but are now very rare. The Calumet & Arizona Company uses about 2,600 lb. of powder per day and sets off about 1,500 shots. The number of missed holes is very low, not exceeding 5 in 1,000. This is due to the efforts of the managements of the different mines to enforce proper preparation of the primers and careful loading of the holes. At the Sacramento Hill open cut, where the heaviest blasting in the district is done and where the greatest tonnage of rock is handled, there has not been a fatal accident since February, 1924. About 9,000 tons of ore and waste are handled daily at the open cut by 5 shovels and 12 to 14 dinky locomotives. More than 70 per cent of the accidents to mine employees occurred in connection with the handling of the ore after it had left the

stope. Not a single accident occurred during the year in handling the skips and cages.

Other mines in the district which show good accident records are the Shattuck-Arizona Mining Co., the Bunker Hill company, of Tombstone, the Central Copper Co., of Dos Cabezas, and the Hilltop Metal Mines Co.

More than 87 per cent of the men working for the bigger companies of the state are American citizens. The good accident record for the district may be attributed in part to the high average intelligence of the miners, but no small measure of credit is due the companies for the efficient safety organizations which they have built up.

Alaska Juneau in November

In November, 1925, Alaska Juneau mined and trammed to the mill 305,000 tons, from which gold and silver to the value of $192,000 was recovered. Recovery was 62.79c. per ton. Operating expenditures were $155,200, or 50.75c. per ton, and operating profit was $36,800, or 12.04c. per ton. Capital expenditures and accrued charges totaled $46,150, leaving a deficit of $9,350.

Additions to the milling plant are reported about 63 per cent completed and Ebner mine preparatory and other preliminary work 61 per cent completed.

Total Dividends of Tintic Standard, $5,871,596

Directors of the Tintic Standard Mining Co. have declared a dividend of 20c. a share and one of 30c. payable on Dec. 23 and Jan. 2. This disbursement, totaling $567,457, will bring grand total of disbursements up to $5,871,596. During 1925, including the dividend of Dec. 23 but not that of Jan. 2, the company will have paid out $1.70 a share, a total of $1,959,955.

Prussia Yields in Sale of Giesche Zinc Mines

Official opposition on the part of the Prussian Government to American participation in the Upper Silesian zinc mining industry, as provided in the arrangement negotiated by the Harriman and Anaconda interests with the George von Giesche heirs, has yielded sufficiently to conciliatory negotiations as to indicate that an amicable settlement of the controversy will be reached.

A newly formed exploiting company, in which Americans hold the controlling interest, will accept Prussia's demand that all ores mined in German territory shall be smelted in Germany. For this purpose, a new smelting company, in which the Prussian Government will also have an active interest, will be organized.

Cornelius F. Kelley, president of the Anaconda Copper Mining Co., who has just returned from abroad, expressed himself as pleased with the outcome of the negotiations between the Anaconda Copper Mining Co. and W. A. Harriman & Co. with George von Giesche heirs relative to the reorganization and financing of the important Polish zinc and coal mines and the German zinc mines, owned by the Giesche heirs.

Ontario Government Purchases Helium Rights in Peel County

Following a discovery that the natural-gas field near Inglewood, in Peel County, Ontario, is rich in helium, the Ontario Government has purchased for $40,000 the helium rights in a block of land including ten farms. The discovery, which was kept a profound secret until the purchase was effected, was the result of researches made by J. C. McLennan, of the University of Toronto, who two years ago was commissioned by the Mines Branch, at Ottawa, to examine the natural gases of Canada with a view to the discovery of helium. Professor McLennan states that an examination of the wells of Peel County showed them to possess the highest helium content of any natural gases as yet discovered in the British Empire. The three wells are shallow, and the gas supply is moderate in amount, but it is estimated that they will provide at least 100,000 cu.ft. of helium annually.

The Scientific and Industrial Research Council has expressed the opinion that a helium-extraction plant should be established in the Inglewood field. The discovery and the taking over of the wells by the province are regarded as highly important, both from a scientific and an industrial standpoint. Helium is greatly in demand among scientific research workers, the present supply being limited to a very moderate quantity produced in the plant at Calgary, Alberta, established during the war. The wells of the Inglewood field have been turned over to the University of Toronto for further research.

Shale-Oil Plant Near Santa Maria, Calif.

Bethlehem Shipbuilding Corporation, Ltd., has just closed a contract with the N-T-U Company calling for the construction at a cost of $400,000 of a plant near Santa Maria, Calif., capable of extracting 1,000 bbl. of oil per day from oil-shale rock. The erection of this plant represents a development of a new process of obtaining oil from shale and is the first large shale extracting plant to be built in America. Two years ago the Bethlehem Shipbuilding Corporation built a smaller capacity plant for this company upon the same property, which has been in successful operation ever since. Three 40-ton units have just been added, and the above-mentioned contract is to bring the capacity of the plant up to 1,000 tons of shale daily.

Mining Engineering Methods Applicable to Oil Shales

Former Commissioner Carroll, of the Colorado State Department of Mines, in an address before the Rocky Mountain Association of Petroleum Geologists, said that he could see how every system of mining practice, including steam-shovel, glory-hole, long-wall, room-and-pillar caving and other methods used in coal, metal, and limestone operations, would be adaptable to mining shale, in different localities. With reference to costs, he said that at Juneau, Alaska, the cost of 50c. per ton by the caving method can be repeated in oil-shale mining. Tests show that a drill running parallel to the laminations would make four inches of hole per minute and in driving across the laminations would make ten inches.

Victor C. Alderson, former president of the Colorado School of Mines, estimates that about $50,000,000 will be spent during 1925 for drilling dry holes. So long as it is oil that is wanted, this money should be expended for the extraction of oil from shale.

The Colorado School of Mines has installed a complete oil-refining unit. Samples of crude oil from the various fields are treated by the students, who run it to finished products. A small model of a 55,000-bbl. steel storage tank equipped with steel coils, pressure, and vacuum valves is used in the study of evaporation losses. Real machinery and tools used in the oil fields have been furnished by the various manufacturers and instruction as to various usages is given.

New Jersey Mineral Production $81,558,477 in 1924

New Jersey has only a few mines, yet the annual report of the State Department of Conservation and Development reveals that the mineral production for 1924 had an aggregate valuation of $81,558,477. This is a decrease of only $751,671 from the peak total of 1923. The reduction is accounted for by slight decreases in quantity or value among some of the less important items which go to make up the state's mineral industries.

The two chief items are pottery, valued at $25,768,316, and brick and tile, with a valuation of $20,445,381. In addition it is shown that stone production of the state for the year was valued at $3,326,298, sand and gravel at $3,331,712, clay at $1,486,032, peat at $172,865, and greensand and marl at $151,205. The remaining $26,776,200 includes the production of cement, coke, fuel briquetts, lime, ground quartz, ground talc, feldspar, iron ore, and zinc ore, the latter being a large item.

Vipond November Production $46,000

During November, the Vipond Consolidated, operating in the Porcupine area of northern Ontario, produced approximately $46,000, from 4,893 tons of ore treated. The new orebody occurring at the junction of the No. 5 and No. 8 vein systems on the North Thompson claim has been found at the 200, 300, and 500 levels, and a crosscut is being run toward it at the 600 level. At the 300 level, where work is furthest advanced, ore has already been developed for a length of 70 ft. over an average width of 20 ft. with the limits of the orebody nowhere reached. New discoveries of importance have also been made on other parts of the property, notably in the northern extension of the central system at the 600 level, where ore of $8.15 grade over a width of 14 ft. and a length of about 40 ft. has already been developed.

New Cornelia Earnings Pay Off Indebtedness

The New Cornelia Copper Co., at Ajo, Ariz., which pays nearly half of Pima County's taxes, will, by March 1, 1926, have paid off $2,000,000 of notes issued to complete the $5,000,000 mill, according to a late announcement. This mill, now completed, with other construction of the last few years, involved an expenditure of more than $6,000,000, all of which has come out of the earnings. With these expenditures entirely out of the way, net earnings can apply directly to dividends. New Cornelia has an operating capacity of 90,000,000 lb. of copper, although this year it will not show an output much over 76,000,000 lb.

The dividend of $1.50 declared a few days ago by Calumet & Arizona, which controls New Cornelia, included a regular quarterly disbursement of $1 and an extra 50c. a share, says the report. "Calumet & Arizona has been holding down production at its Bisbee property in recent months to help out the copper situation. Bisbee is operating at the rate of 6,000,000 lb. of copper monthly, or 72,000,000 lb. per annum. It is entirely possible that New Cornelia will show earnings of close to $3 a share this year, and it is perfectly evident that, operating at capacity, and on no higher than a 15c. metal market, the company can show around $4 a share earned."

Rico Mining & Reduction Co. Developing on Large Scale

The Rico Mining & Reduction Co. began operation in Rico, Colo., last May. It has acquired nine separate properties spread well over the entire district and covering a large portion of the mineralized area. Development work has been undertaken on all properties on an extensive scale. Compressors, hoist, and pump equipment have been installed or ordered for all properties and a program of intensive development has been planned for the winter. A 580 hp. plant, steam driven, will be completed by Jan. 15. Grading has started on a 100-ton flotation plant but the erection will probably be delayed until spring.

The company has bought and is operating a coal mine six miles from Rico. High-grade coal is being mined at a rate sufficient to supply the company's own needs. All operations are in charge of Stanley M. Walker, general manager.

China-Clay Deposits in Ontario to Be Developed

Arrangements are in progress for the formation of a company capitalized at $7,500,000 for the development of extensive china-clay deposits situated at Kaolin City, on the Mattagami River, in northern Ontario, about 32 miles northwest of the present terminus of the Timiskaming & Northern Ontario Railway. The promoters of the enterprise are William Douglas, Sr., and Edmund Bristol, of Toronto, and Charles M. McCarthy, of Elk Lake, Ont. It is proposed to take over 400 acres of clay deposit. This deposit is claimed to be one of the largest and most valuable of its kind in the world and has been subjected to a close examination by Sydney Harnack, a British engineer. The plans of the syndicate include the construction of a plant at Kaolin City with a capacity of 500,000 tons yearly.

Aravaipa Mining Co. Preparing to Develop Its Properties

The Aravaipa Mining Co., at Aravaipa, Ariz., which is controlled by the Grand Central Mining Co., of Fairbanks, Ariz., is making preparations for development and extraction of its lead ores. Roads to connect the various parts of the mining property are being built. The next important improvement will be the building of a pipe line from Tule Springs to Aravaipa, as all water is at present being hauled from the springs in wagons. Lewis Douglas is president of the company, and Harry Hendrickson is in charge of operations.

Tasmanian Zinc Industry Prosperous

The annual report of the Electrolytic Zinc Co. of Australasia, Ltd., indicates steady progress in the Tasmanian zinc industry. At the beginning of 1925 distribution of superphosphates was undertaken, and the grade offered by the company appears to be satisfactory to the market, the tonnage of sales to date this year being equal to that by mainland companies selling in Tasmania in 1924. Comparison of sales shows that Tasmania has a smaller demand for superphosphate than other states, owing, it is claimed, not to a better soil but to failure to appreciate the value of fertilizers. A campaign for the demonstration of their value to the Tasmanian farmer has been initiated.

Relinquished Option on Doratha Morton Taken Up By Tonopah-Belmont

Porcupine Goldfields Development & Finance Co. recently relinquished its option on the Doratha Morton mine and the adjoining Enid and Julie groups, at Fanny Bay, B. C., and the Tonopah-Belmont Development Co. at once took a short option on these mines and claims. Clyde H. Heller, president of the company, has made an examination of the property, and P. W. Racy, one of the company's engineers, has arrived from Tonopah to examine and sample it.

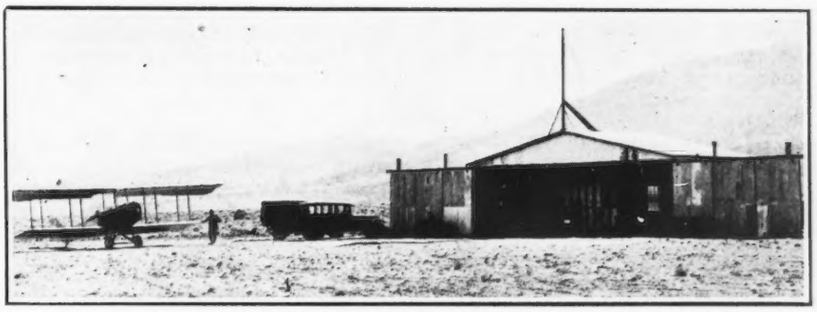
Mining Company's Plane Saves Money

Out in the mining districts of Nevada, where distances are great and roads are mere trails, there is often need for a speedy means of transportation. That is why the Mono Mining Co., Sweetwater, Nev., has bought a three-passenger "tourabout." This plane is equipped with a 180-hp. motor and is proving highly serviceable. The flying field is a clearing in the desert, about 2,500 ft. square, at an altitude of 6,700 ft., and is one of the highest flying fields in the United States. The plane is kept in an all-metal hangar.

This ship is used principally for business trips to adjoining towns, and in emergency cases such as accidents and breakdowns. Reno is 110 miles distant, over very bad roads, and requires about five hours of driving by auto. The company purchases equipment in Reno and also has repair shops there. This trip can be made, by air, in from forty-eight to fifty-one minutes. The company has already saved the cost of the plane more than three times over in emergencies and repairing breakdowns.

The mine power plant is 35 miles to the south of the mines, and the roads are bad. It usually requires more than two hours, by auto, or about eighteen minutes by airplane, to make the trip. As trips are usually of an urgent nature, the time-saving feature is highly important.

The railroad station is 65 miles distant. This trip takes nearly three hours by auto, but less than twenty-five minutes by air. Practically all the small purchases and all the express come to this point. It usually requires from two to three days to get this material to the mine, but if there is urgent need for anything, one and a half hours places it on the job.



Aviation field, Mono Mining Co., Sweetwater, Nev.

Burke and Mullan, Idaho, Connected by Underground Passage

When the Star crosscut in the Cœur d'Alenes recently holed into the old workings of the Morning mine, the towns of Burke and Mullan, four and a half miles apart, with high mountains between them, were connected by an underground passage. This is the culmination of years of work which the Hecla Mining Co., developing the Star vein, has brought to a successful conclusion. The crosscut has opened, explored, and developed the famous Star vein on the 2,000 level below the surface plant of the Hecla mine at Burke.

Iron Mines Plan Extensive Underground Work During Winter

The Oliver Iron Mining Co. and the independents in Minnesota plan to carry through substantial programs of stockpiling at the underground mines during the winter. Work will be especially active on the Vermilion range. The Pioneer mine there, the largest underground mine in the state, will maintain a full crew. At the Soudan, another Oliver mine at Tower, it is proposed to accumulate a large stockpile during the winter.

Full crews will be employed by the Oliver and the independents at mines in the Hibbing and Virginia districts, and it is thought mining conditions in the Lake Superior district will be better than in several years.

Fire Protection at Butte Mines

Notable advances in safety standards as regards mine fires have been attained in recent years in the great metal-mining district of Butte, Mont., states the U. S. Bureau of Mines, following an investigation of conditions in that district. The improvement in safety work in the Butte district is typical of improvement recorded in other large metal-mining centers of the United States within recent years. No other metal-mining district now being worked in the United States can show such intensive mining in a small area, and probably in none have the mine operators to cope with more difficult mining conditions.

The largest old mine fire area has been filled with slimes, and the abandoned ore is now being mined. Virtually every mine now in operation has on the surface a large ventilating fan with fireproof setting arranged for quick reversal. Numerous fireproof fire doors have been installed. Coursing the air is practiced as in coal mines.

For fire protection, besides the fire doors, some of the downcast shafts have been smooth lined with concrete slabs, which incidentally lessen air friction; other shafts have been gunited or coated with cement, and many of the shaft stations, small-fan installations, and ventilating-door frames have also been gunited. Water lines extend to all working places and there are numerous taps for fire fighting. Fire hose and extinguishers in some mines are kept ready for use at shaft stations; at other mines these are kept on the surface.

All the mines now active have fire-fighting organizations with men trained in the use of oxygen-breathing apparatus. At some of the individual mines this apparatus is kept ready for use. The largest mining company has two well-equipped central fire-fighting and rescue stations, with firemen in constant attendance, and it has facilities for calling out over a hundred trained men in any emergency. More than 500 men in the Butte mines have been trained in the use of self-contained oxygen-breathing apparatus, and many others have been trained in giving first-aid treatment.

College Students Veto Four-Year Mining Course

Students of the Michigan College of Mines at Houghton have vetoed the suggestion that the course of study be enlarged from its present three-year basis to four years. Arguments against a four-year course were presented by members of the student organization as follows:

About 75 per cent of the students come to the Michigan College of Mines because of the opportunity to graduate in three years. This is especially important to those who have to pay their own way through school. Those who think campus activities are of the utmost importance can arrange schedules so as to graduate in four, five, or six years as they may elect.

Much of the reputation of mining graduates is due to their ability to work at high pressure when necessary, which they feel is what they do when completing the course in three years, of four terms each, with only a three or four weeks' summer vacation.

Rumor Henry Ford Will Buy United Verde Denied By Officials

A DENIAL that representatives of Henry Ford were in Arizona negotiating for the purchase of the United Verde Copper Co. was issued recently by officials of the company in Jerome, as the result of a rumor that Henry Ford would add the big copper company to his numerous holdings.

Kay Copper Co. Sinking Winze From 1,200 to 1,500 Level

Reports coming from Canon, Ariz., indicate that encouraging results are being obtained in the winze that is being sunk from the 1,200 level of the Kay Copper mine. The winze was started in the footwall, and a few feet below the 1,200 level ore began to appear, and has persisted from that point. On the hanging wall side of the vein the 1,200 level shows from 8 to 10 ft. of chalcopyrite.

Sinking of the winze is a little behind schedule, owing to difficulties encountered by successive contractors. The sulphide ore is not only hard to break, but is difficult to handle after it has been broken. Being dissatisfied with progress of the work under the contract method, the company has taken over the work and is now making better headway than at any previous time, the present rate of advance being over three feet per day. Diamond-drill records indicate the existence of an orebody 35 ft. wide at a depth of 1,460 ft.

Dredge Causes Trouble and Quits

The South Park Dredging Co. was sued for polluting the waters in the Platte River near Fair Play, Colo. Suits came too thick, and the company closed up with the declaration that it would dismantle.

Federal M. & S. Co., Bonds Li-Li-Kel Claims Near Blackwater, B. C.

The Federal Mining & Smelting Co. has bonded the Li-Li-Kel group of eight claims and a number of surrounding claims, situated along Tenquille Creek, a tributary of the Birkenhead River, and 14 miles from the Pacific Great Eastern Railway, at Blackwater, B. C. Comparatively little work has been done on the property, but some promising bodies of ore, ranging from one to 25 ft. in width, have been exposed. One deposit, two to eight feet wide, carries stringers and lenses of galena, containing 25 ounces of silver per ton; another opening shows a foot of ore heavily mineralized with arsenopyrite and carrying important gold values; while still another, 25 ft. wide, is mineralized with pyrite, arsenopyrite, pyrrhotite, galena, and sphalerite, and carries fair gold and low silver values.

Efforts to Establish Smelter at Gold Hill, Ore.

Last year the mine operators in southern Oregon and northern California in conference concluded that a smelter was essential to bring about a general resumption of the mining of copper and gold in southern Oregon, and it was the consensus of opinion that Gold Hill was the logical point for the proposed smelter. Gold Hill is on the main line of the Southern Pacific Railway between Portland and San Francisco, and has a number of mines with sufficient output of ore to operate a smelter.

The West Coast Finance Co. was organized to build the smelter, but failed to finance the project. The Sunset Smelting Co. was then organized by Gold Hill business men, took over the assets of the defunct company, and began a systematic investigation of the whole project. But little progress was made in determining the proper treatment of the ores in this region until Herschel C. Parker demonstrated that the ores which the local miners classed as telluride were not actually telluride, but were arsenopyrite carrying the telluride of gold and associated with chlorite rather than with quartz. Ore of this character has been found by Dr. Parker in the Greenback mine, in the Grant's Pass district, and in the Kelmar-Vanpet mine, at Gold Hill. This ore, according to Dr. Parker, only responds to smelting or chlorination.

The several mine owners and the smelter company are combining finances to erect the first unit of a smelter and a chlorination plant.

Lake Iron-Ore Shipments 54,081,298 Tons

The Lake Superior iron-ore shipments for the season of 1925, just closed, were 54,081,298 tons, or 27 per cent over 1924 and 8 per cent under 1923, the record post-war year. This year's ore movement bears the same percentage relation to the year's pig-iron production as the average of the last six years.

Washington News

By Paul Wooton

Special Correspondent

Bureau of Mines Advisory Committee Report Approved

Director Turner to Assume Duties Early in January — Housing a Difficult Problem

The recommendations of its subcommittees in regard to the reorganization of the Bureau of Mines were approved by the full advisory committee which met in Washington on Dec. 12. These recommendations embody the plan for the creation of an economic branch, for the transfer of the coal and minerals divisions from the Bureau of Foreign and Domestic Commerce and certain mineral statistics from the Bureau of the Census. The details of these plans already have been set forth in this correspondence.

Some objection has arisen to the actual rescue operations of Bureau of Mines crews. The committee has no thought of recommending anything that would pave the way for the building up of a great mine rescue activity. The desire is to concentrate safety work on matters of instruction and demonstration, but the committee does not see how it can restrict rescue operations when the bureau's cars are near enough to a disaster to render aid, when it is requested by the state authorities and the mine operators. Actual participation in rescue work, however, will continue to be an incident to the operation of rescue cars.

All of the recommendations which have been approved thus far are to be drafted in final form at once. The next meeting of the advisory committee will be held in Washington the last week in January. On that occasion the committee will meet with Director Turner, who by that time will have had an opportunity to familiarize himself with the application of the changes which have been suggested. Mr. Turner expects to begin his active duties immediately after the first of the year.

Lack of Office Space

The Bureau of Mines is confronted with an uncertain situation as to its housing. To accommodate the additional personnel of the new divisions more space is necessary. No additional offices are available in the Interior building, where the Bureau now has its offices. Consideration is being given the transfer of the maritime bureaus of the Department of Commerce to the Pension building, which would make room enough to house all of the Bureau of Mines activities in the main Commerce building. Every effort will be made to secure in the Interior building the additional space needed, as it would be difficult to move the Bureau's laboratories which occupy specially constructed quarters in that structure.

Unexpended Minerals Relief Appropriations

An attempt is being made to prevent the return to the Treasury of the unexpended balance of the War Minerals Relief appropriation until Congress shall have had an opportunity to pass upon a bill introduced by Senator Oddie, providing for the extension of the act so as to authorize reimbursement for losses in connection with the purchase or leasing of properties and for interest paid on borrowed money used in producing or preparing to produce for war purposes, the minerals included in the law.

French and American Potters' Flints Studied at the Bureau of Standards

The appearance and service qualities of whiteware (that is, the cheaper and medium-priced domestic chinaware and vitreous, translucent porcelains) are dependent primarily on the chemical and physical properties of the constituent raw materials. As a part of a general study of these raw materials, the Bureau of Standards of the Department of Commerce has made an extensive investigation of potters' flints.

Potters' flint is pulverized quartz, as prepared for use in the pottery industry. The effect of potters' flint in body compositions is to promote rigidity of structure, reduce drying and burning shrinkage, and usually to raise the maturing temperature. Flint has an important bearing on the resistance of ceramic bodies to physical shock, because of its peculiar expansion effects at kiln temperatures.

American flints are generally prepared from relatively coarse crystalline quartz, while the imported French flints are prepared from quartz pebbles of a peculiar extremely fine crystalline form.

The chemical analyses showed that more than half of the flints contained over 99 per cent silica, and from 0.03 to 0.12 per cent iron oxide. Lime was generally low or absent in American flints, and averaged 0.42 per cent in French flints. Tests for fineness showed that 95 per cent of the material as marketed was fine enough to pass a No. 325 sieve, and from 50 to 55 per cent a theoretical No. 1000 sieve.

The investigation included a study of the effects of changes in the crystal form of silica, and correlated tests on the resistance of fired whiteware bodies to thermal shock. It was found that bodies showed the greatest liability to failure at about 1060 deg. F., at which temperature crystal changes in silica are known to occur. Bodies containing the French flints showed greater resistance to failure at this temperature than those containing American flints, but slightly less resistance at temperatures below 390 deg. F.

Physical tests on bodies showed that the French flints do not appreciably lower the maturing temperature of a body, but tend to develop effects of over-firing earlier. It was found that an American quartz flint of fineness beyond the limits of grinding now commercially practicable for potters' flints materially reduced the maturing temperature of a body without causing any marked tendency to develop overfiring defects.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Ontario Wins Suit for Extension of Railway Into Quebec— Case May Be Appealed to Privy Council

The Province of Ontario has won the first round of its suit with the Quebec Government, for the right to extend the Nipissing Central Railway into the Rouyn district of northwestern Quebec. The Supreme Court of Canada has given judgment to the effect that the Dominion Government has the right to authorize the Nipissing Central, which is a subsidiary of the Ontario Government's T. & N. O. Railway, to build across Quebec crown lands. The question turned upon the interpretation of Section 189 of the Railway Act, under which no railway company may take possession of crown lands without the consent of the Governor-in-Council. The Nipissing Central was incorporated by dominion charter in 1907 and in 1924 the Dominion Railway Board approved its general location plan of the portion of the line to be constructed between the Ontario boundary and Quebec mining district. The company petitioned the Governor-in-Council for consent to occupy the necessary crown lands, but objection was taken by the Quebec Government, and the Dominion Government referred it to the Supreme Court for opinion. The judgment was not unexpected, because in 1906 the Judicial Committee of the Privy Council gave judgment in a somewhat similar case involving the Province of British Columbia and the C. P. R. It is believed that Quebec will appeal to the Privy Council, but in view of the former decision it is thought the judgment is unlikely to be upset. In the meantime the Rouyn Mines Railway is being constructed from the C. N. R. south, but will not be in operation before the end of next year. The objection taken to the construction of the Nipissing Central means a delay of about a year in providing railway facilities to this important district.

Amulet to Extend Drilling Campaign

Directors of the Amulet Mines, of Quebec, have decided to enlarge their diamond-drilling program and have let a contract for drilling the recently discovered No. 4 area. Channel sampling has shown values up to 35 oz. of silver, 11½ per cent copper, and 19½ per cent zinc. The chief values seem to be represented by silver and zinc, the silver being much higher than has been found in any other place in the district.

Ontario's Best Year for Metal Mines

The report of the Ontario Department of Mines for the nine months ended Sept. 30 shows a total output from the metalliferous mines, smelters, and refining works valued at $45,600,000, an increase of $9,400,000 compared with the corresponding period of the previous year. In their order of importance the chief metals were gold, nickel, silver, copper, cobalt, and platinum. The production of gold established a new high record—in the Porcu-

pine camp 2,236,000 tons was treated, the average recovery being $8.30; in the Kirkland camp, 275,000 tons was treated, the average being $14.63. There was a slight falling off in the production of silver from Cobalt, but this was more than made up by the increased production from South Lorrain and Gowganda.

RAILROAD COMMISSIONERS ORDER REDUCTION IN FREIGHT RATES ON EXPLOSIVES

The Board of Railway Commissioners for Canada has ordered a reduction in freight rates on high explosives. These rates will mean a saving of 25c. per 100 lb. to the gold and silver mines of northern Ontario and approximately 36c. per 100 lb. to the mines of the Sudbury district. Taken in conjunction with the reduction in the price of explosives, which came into effect Nov. 20, this means a substantial saving to the operators. It is reported that the railway companies may appeal against the judgment of the board, but it is felt that this action will not be taken with any expectation of success but solely to stave off the reduction as long as possible.

CROWN RESERVE DISCOVERS NEW ORE

The most important new discovery among the gold mines during the past week has been that on the Crown Reserve mine, in Larder Lake, where diamond drilling has indicated a new vein a considerable distance north of the present workings. The drill passed through 50 ft. of mineralized material which assayed from $3 to $9 a ton. It is also reported that arrangements are being made to finance the property to a producing stage.

DOME'S BEST MONTH

During the month of November, the Dome Mines, of South Porcupine, treated 43,739 tons of ore and recovered $379,990, an average of $8.69 a ton. This is the best month so far this year, and there has been a steady improvement in the grade of the ore since last August, when the average recovery was $8.10 a ton. For the year to date, there has been treated 484,039 tons, giving a recovery of $3,985,176, an average of $8.24 a ton, and these figures are considerably in excess of those of the previous year.

NIPISSING REPORTED TO HAVE SILVER DISCOVERY

The operations of the Nipissing company, of Cobalt, on its property in South Lorrain, adjoining the Canadian Lorrain, are being watched with interest, and it is reported unofficially that a discovery of silver has been made. Nipissing operations on outside properties have always been conducted with secrecy, and nothing definite will be given out until the company knows more about the new discovery. The company has declared the regular quarterly dividend of 3 per cent payable Jan. 20. As of Dec. 9, the financial statement shows liquid assets consisting of cash, government bonds, investments, and ore and bullion amounting to $4,232,098.

The Mining Corporation has declared a dividend of 12½c. a share payable Jan. 30 to shareholders of record Jan. 15. The Genessee property is being reopened, and it is expected that it will be dewatered to the 350 level by Jan. 1. The company produced 160,000 oz. of silver in 1924. Operations on the Menango property are being curtailed and may be confined entirely to exploration work.

Mine Operators Have Confidence in President Calles of Mexico

AMERICAN and other foreign mining interests of Mexico have a strong feeling of confidence in the administration of President Calles, according to Heath Steele, president of the Peñoles Mining Co., of Monterey, and vice-president and managing director of the United States Metals Refining Co., Ltd., of New York. Both of these companies are largely interested in the mining industry of Mexico. He completed an inspection of all the properties of these companies just prior to his departure for New York. He said that the mines are being operated regularly and that the output of ores, both as to quantity and quality, is satisfactory. None of these properties are situated within the border zone which comes within the proposed alienation act, it was stated.

"Mexico is getting better and better every day," he declared, "and I have no complaint to make of present conditions in any part of the country of which I have knowledge."

Duthie Mines Ship Ten Tons Daily

J. R. Turner, manager for Duthie Mines, which is operating the Henderson mine, 13 miles from Smithers, B. C., has announced that since the property reverted to J. F. Duthie, early in last summer, sufficient ore had been developed to enable the company to ship ten tons per day for the next eighteen months without adding to the reserve. The ore is netting the company an average of $90 per ton on board cars at Smithers. Additional men are to be taken on at once, and production and development will be pushed.

After some years of agitation, Mr. Duthie has induced the Canadian National Railway to put into force a better freight rate between Smithers and Trail, which at the present rate of shipping means a saving to the company of about $40 per day. The Federal M. & S. Co. had an option on a 55 per cent interest in this property for more than a year but allowed it to expire.

The Cassiar Gold Rush of 1925

About $7,500 in gold was produced, according to W. A. Johnston of the Geological Survey of Canada, from placers on Goldpan Creek, Cassiar, B. C., during the summer of 1925. It was on Goldpan Creek that the find was made in the autumn of 1924 that led to the rush into this district in the spring of 1925. This creek is a tributary of Little Eagle River, and is 11 miles due east of the head of Dease Lake.

All the mining was done by hand, as in the '70s, when the Cassiar district was the scene of considerable activity. Nearly all the gold was obtained on the lower part of the creek from the Discovery claim, 1,000 ft. long, and from claims No. 1 above and No. 2 below, each 250 ft. long. The creek was mined out for a length of 565 ft., the gravel averaging 3 to 5 ft. in depth. Some gold was found in the upper parts of the creek, which is nearly 4 miles long, and on its tributaries, but apparently not in sufficient quantity to pay for working by hand methods.

Considerable prospecting was done in other parts of the region and extended as far north as Frances Lake, east to Muddy River, and in the west on the first north fork of Clearwater River. One party of prospectors used a hydroplane for moving from one part of the region to another, as well as for flying in and out of the country. Late in the autumn, a discovery of placer gold on low benches in the canyon of the first north fork of Clearwater River, about 25 miles above the mouth of the Clearwater, was reported, and a number of prospectors went into the area. No information is available as to the importance to be attached to the new discovery.

Machinery, including a drag-line scraper outfit, over thirty tons of hydraulic pipe, and a Keystone drill for mining and prospecting on Dease, Thibert, and McDame creeks, on which most of the mining was done in the early days, were taken into the district last summer, so that the past summer witnessed a marked revival of interest in the possibilities of the region, which has been dormant for a number of years.

Projected Development of Outokumpu Copper Mines

The committee appointed by the Finnish Government several months ago for the purpose of making recommendations for the future development of the Outokumpu copper mines in Finland, recently rendered its report, in which the opinion is expressed that these deposits furnish the means of eliminating importation of copper and reducing considerably the present sulphur imports. The mines are said to contain from 7,000,000 to 8,000,000 tons of ore, and it is proposed that exploitation should take the initial form of covering the sulphur demands of the state sulphuric acid plant at Kotka and cellulose mills in the immediate neighborhood of the deposits, that an electrolytic copper plant be built in South Finland, and a factory for producing copper cable. It is not considered probable that the domestic consumption of copper and sulphur can be supplied by the mines in the beginning, so it is considered that a part of the ore should be exported.

London Letter

By W. A. Doman
Special Correspondent

Russian Manganese Production 63,000 Tons in September—Cornwall's Tin Boom

London, Dec. 1.—In a recent letter I mentioned the manganese concession in Russia which Harriman & Co. had secured. It is now stated that the first month's production of the new company has broken the record at Chiabury. The total output in September was 63,000 tons of ore, an increase over the August figures of more than 86 per cent. According to reports the washing of manganese has increased by 18.4 per cent. It is also stated that new layers of radium-uranium-tar ore have been found in northern Karelia near the Finnish border.

Owing to the rise in the price of tin, mining for the metal in Cornwall has received a great stimulus. Many old workings are being reopened and operated by local syndicates, and experts state that despite the age-old production there is still more tin yet to be won in the Duchy than has been taken out. The latest company to apply to the public for capital is the Tolgus Mines, which has offered for subscription at par its 208,000 reserve shares of 5s. each. The company is a subsidiary of the East Pool and Agar, and the ore won will be treated at the East Pool mill. This seems to be the only really weak spot in the proposition. In parts the lode assays 70 lb. of tin to the ton of stuff.

A. Chester Beatty, with his Selection Trust, Ltd., and associates, have taken a one-year option on a tin mine in Cornwall. This is a new development in the country's industry, and indicates that outside capital is available for testing properties. Whether A. Chester Beatty will go deeper into the matter depends upon the success met with in his first venture.

Renewed attention is being paid to the Aporoma Goldfields, in Peru. Working capital amounting to £24,000 has been guaranteed, and Merricks, Crane & Co. have undertaken a mission to the property. These goldfields were worked many years ago, but have lain idle since. New methods and the desire to open out new deposits of the precious metal have induced the present interest in the company.

Although no definite infromation of an official character is available, it is reported in a Continental journal that a new company is to be formed to work the Lena Goldfields Concession. This, it is thought, may mean either that the shareholders in the original company may be paid out or that the Soviet authorities will only grant a concession to work to an entirely new undertaking, ignoring the old. Meanwhile, as the shares were rushed up from a very low figure to about 8s., someone has netted handsome profits.

Following on what I recently wrote regarding the West Rand Consolidated reorganization scheme and the rather clever financing, it is believed that the General Mining & Finance Corporation has done extraordinarily well out of the business. The present West Rand Consolidated has an authorized capital of £2,275,000, of which £25,000 is in deferred shares of £1 each. These 25,000 shares were originally held by the West Rand Trust, in which one or two Kafir houses were interested. According to the constitution of the mining company, after a total of 100 per cent had been distributed in dividends on the ordinary shares, 25 per cent of the profits were to go to the deferred shares, i.e. the West Rand Trust. Some months ago the General Mining Corporation acquired the whole of the trust shares, and wound up the trust, so that it now holds all the deferred shares in the West Rand Consolidated. The question is being asked, When do the deferred shares rank for dividend? After £1,500,000 has been paid on the ordinaries, as originally, or after £1,000,000 is paid? If the latter, the General Mining is in clover, for if the developments in the mine continue good there should be no difficulty in distributing £1,000,000, especially as the debentures will be paid off. What is more, the deferred holders had the right to apply for 500,000 of the new shares at 10s. 6d., and as these stand in the market at over 14s. there is a handsome profit on the deal.

Decreasing Gold Yield in Australia—Excess Labor in Tasmanian Osmiridium Areas

The gold yield for the Commonwealth of Australia for the first eight months of 1925 was 368,631 oz., against 450,001 for the corresponding period of 1924 and 464,322 for 1923. Depression in the copper-mining industry of the state is largely responsible for the decline, and in addition most of the state-owned gold mines have been closed. There is consequently some agitation for a bounty for the gold industry as protection for the labor involved.

Late Trade Commissioner reports from the Adams River osmiridium field in Tasmania state that there is danger of overmanning, the field being considered by experts as capable of supporting 300 men, whereas about 1,000 are there at present, only about 100 of whom are earning high wages. Other reports indicate that water is scarce, and that some of the claims will have to be abandoned.

Consolidated M. & S. Co. Purchases Metal Refinery Near Ottawa

The Consolidated Mining & Smelting Co. of Canada has purchased the refinery at Deschenes, Que., opposite Ottawa, built by the now defunct British American Nickel Co., Ltd. This refinery was erected to handle nickel matte from the Sudbury area, but it was barely finished when the war ended and the price of nickel slumped.

Acquisition by the Consolidated Smelting company is said to be with a view to handling concentrates from the northern Quebec field.

Johannesburg Letter

By John Watson
Special Correspondent

Pilot Plants for Testing Platinum Areas Nearing Completion—Options Exercised on a Number of Farms

Johannesburg, Nov. 10—The following are the results for the month of October, from fourteen leading gold mines of the Rand. They are arranged in order of profits earned:

	Tons Crushed	Revenue or Value	Costs per Ton s.	d.	Estimated Profit
Government Areas.....	170,000	£323,515	16	10.1	£184,094
New Modder.	133,000	278,695	17	0.1	165,581
Crown Mines.	210,000	282,167	19	1.2	81,593
Modder Deep.	45,300	102,184	15	3.0	67,584
Springs.....	70,000	131,363	20	0.0	61,362
Brakpan.....	88,000	140,823	18	6.4	59,270
New State Areas.....	75,000	129,678	19	7.6	56,373
Van Ryn Deep	68,000	111,011	17	8.4	52,630
Geduld.....	82,000	119,760	17	5.0	48,478
Modder B....	65,000	111,124	19	5.2	47,976
City Deep....	100,500	154,352	22	5.7	41,397
Randfontein Estate.....	202,000	209,257	17	6.4	34,974
West Springs.	49,000	75,972	17	7.7	32,750
Robinson Deep	73,000	.....	16	7.2	22,552

A report for the last quarter has just been issued by the Lydenburg Platinum Areas, Ltd. Good progress has been made with the erection of the plant on Dwarsriver and with preparatory work on Maandagshoek. Both plants are designed to treat fifty tons of ore per day. It is hoped that the Dwarsriver plant will be ready for work by the end of January and that on Maandagshoek by the end of March. Houses, offices, assay plant, and store sheds are being erected on both sections. Up to date the following options have been exercised:

Maandagshoek, farm No. 148, approximately 4,994 morgen (South African morgen = 2-1/9 English acres); Chieftainsplain, No. 169, 2,692 morgen. Portion of Evstegeluk, No. 348, 337 morgen; Freehold and mineral rights on these three portions. On Dwarsriver, No. 86, 4,053 morgen, mineral rights only. Portion of Kalkfontein, No. 22, 3,116 morgen, Freehold only. Laboratory trials indicate that, on sulphide ore, an extraction of about 90 per cent and a concentrate of about 5 per cent by weight of ore treated will be obtained in practice.

On the Johannesburg Stock Exchange, during the last week, there has been large dealing in gold shares, prices of which have, however, been somewhat irregular. Land and platinum shares have, on the whole, declined.

Zinc Export Association Opens Office in New York

E. V. Gent has been appointed manager of the Zinc Export Association, Inc., and offices have been opened at 61 Broadway, rooms 902 and 903—telephone number Bowling Green 4769—and are now ready for business. Many of the producers of Prime Western spelter have joined as members of the association.

Delegates to the Twenty-eighth Annual Convention of the American Mining Congress held in the White Hous

Mining Congress Convenes at Washington

Annual Meeting Held at Capital for First Time in Years—Taxation, Industrial Relations and Value of Joint Selling Agencies Discussed—Secretary Hoover Speaks

Staff Report

CREATION of an economic division within the Bureau of Mines which should perform the economic functions hitherto performed by the other branches of the Interior and Commerce Departments was discussed by Secretary of Commerce Hoover at the annual banquet of the American Mining Congress in the New Willard Hotel, at Washington, on Dec. 9. The advisory committee appointed by Mr. Hoover, consisting of representatives of the industry in its various phases, had all agreed, he said, that there should be a division of this character within the Bureau. Those of his audience who had wondered what the recent transfer of the Bureau of Mines from the Department of the Interior to the Department of Commerce signified, had not realized, said he, that the economic relationships of the mining industry lay in the Department of Commerce rather than in that of the Interior. To serve the mining industry in the economic field as well as in the scientific field, he said, would be to improve the service that the Bureau had been rendering to the industry. Never had he thought it possible to catch an economic force with a policeman. The mining industry was very old, he said, and through the centuries had succeeded in supplying man with needed minerals. What it needed today was more information, both of a technical and of an economic character, some of which could be obtained only through the agency of the government. His official position, said the Secretary, was to co-operate with industry in those things that make for its welfare. The phrase "to promote and foster" an industry occurred in the organic acts of both the Department of Commerce and the Bureau of Mines. The word we used today was "co-operate," he said.

The Bureau of Mines had had a long and honorable career, continued Mr. Hoover. In it was a remarkable body of men, he said, especially so when the limitations of government compensation were considered. All regretted to have lost H. Foster Bain, the retired Director of the Bureau (now secretary of the A.I.M.E.), he said, but believed that in Scott Turner an able director had been found.

He had no speech, the Secretary said at the outset of his remarks. He had come rather to welcome the mining men before him. He had thought to break bread with old friends, associate with the profession and get "the smell of the mine" once again, perhaps.

The other speakers at the banquet were the Hon. J. J. Manlove, Representative in Congress from Joplin, Mo.; Harry N. Taylor, president of the United States Distributing Corporation, of New York, and Senator Tasker L. Oddie, of Nevada. Mr. Manlove had addressed the taxation conference earlier in the day, and therefore spoke briefly, concluding with an invitation to the audience to visit the Missouri-Kansas-Oklahoma lead and zinc district next year. Mr. Taylor, whose company is in the anthracite business, declared that the present situation in the anthracite industry was not a crisis and intimated that the public that had become used to burning hard coal could readily find substitute fuels to use, instead. Anthracite men were not worried by the situation confronting domestic consumers, he said, because these would return to using hard coal as soon as it was again available, but they were concerned with the possibility of losing their markets for steam sizes of anthracite which constituted 50 per cent of the production. Senator Oddie eulogized Secretary Hoover and said that mining legislation would now have the latter's scrutiny, and, citing the story of an old prospector who promised to try to find an orebody containing just the metals that his grubstaker most desired, of a certain specified grade and of certain desirable dimensions, the Senator said that the mining industry might now hope for legislation according to specifications.

Sessions Held at New Willard

The banquet marked the end of the first day of the twenty-eighth annual convention of the Mining Congress, the first annual meeting to be held in the national capital in many years. Delegates and guests had registered in the morning in the Fairfax Room of the New Willard, where the convention had its headquarters. No effort had been made to secure a large attendance, the Secretary of the Mining Congress, James F. Callbreath, said at the opening session, but rather the presence of the leaders of the industry had been chiefly sought. D. B. Wentz, vice-president of the congress, presided at this session. Louis S. Cates, president of the organization, whom the illness of Mrs. Cates prevented from attending, sent a copy of the speech that he had planned to make, which was read by Mr. Callbreath to the delegates. Mr. Cates said in part:

"As American mining men we naturally give first attention to the world situation when we consider the state of our industry. Our dependence on other nations for the maintenance and expansion of American mining is so important a fact that we can make no competent survey of our own situation without knowledge of foreign as well as domestic conditions.

"Our knowledge of the foreign conditions that most intimately affect us is not ideally complete, but we have enough to indicate that reconstruction has become more than a hope or a prospect within the last year; that it is at last a moving fact with increased promise.

"The fact that many foreign national debts have been funded or are in proc-

Washington, D. C., the week of Dec. 7-12, with their guests, assembled with President Coolidge grounds, on Dec. 10.

ess of funding would of itself be substantial encouragement to us who must seek markets overseas, yet this is only one of several indications that the foreign customer nations of the American mining industry have their task of rehabilitation well under way and are rapidly stabilizing their finances and business, public and private. We have already felt the effects directly in our industry and can expect increased benefits as time passes. Although most operations have not yet reached the post-war basis where the spread between cost and income is equal to what it was prior to the war, the trend is clearly that way. Steady improvement rather than sudden change is indicated.

"The year at home has been generally uneventful in the industry. Markets were somewhat improved in many instances and operations were fairly steady in the metal mining field. The year was not generally satisfactory in the coal-mining field, which continues to suffer as the result of too much attention from people that know too little about it.

"It is a gratification to note that the agricultural situation has greatly improved, after several unsatisfactory years. Agricultural prosperity benefits industry in general, as well as those directly engaged in farming and allied activities. The farmer and the miner have much in common and are usually together in prosperity and adversity."

In considering reports of committees Mr. Callbreath said that the Mining Congress, not having a Transportation Division, had appointed a committee to study the situation arising from the enactment of the Hoke Smith bill. This bill favoring the agricultural interests, it was feared that the mining industry would be called upon to bear an unfair share of the burden. The committee, whose chairman is F. W. Pullen, head of the Phelps Dodge Corporation's traffic department, had, however, reported that nothing should be done for the time being. A motion to this effect was seconded, and carried.

Brief surveys of mining conditions in various sections of the United States were then called for by the chairman, Colonel Wentz. Josiah Keely, of the Cabin Creek Consolidated Co., told of the situation in the coal fields of West Virginia; John M. Sully, general manager of the Chino Copper Co., gave a favorable report on New Mexico. Julian D. Conover, of the Tri-State Lead, Zinc and Ore Producers' Association, speaking of the Joplin-Miami district, said that 169 mills, the largest number in the history of the district, were running and producing 17,000 tons of zinc concentrates and 3,000 tons of lead concentrates per week. Prices were good, he said, and about eighteen mills were being built, or about to be in the near future. The district had always been remarkably free from labor troubles.

Taxation and the New Revenue Bill

Paul Armitage, of New York, presided at the second session, on the afternoon of Dec. 10, which was devoted to the subject of mine taxation. Attacking the mining industry seemed to be a favorite sport, he said, especially in the matter of the income and excess profits taxes. The industry did not mind being attacked, he said, but did resent the secret, star-chamber methods of the Senate Committee on Investigation of the Bureau of Internal Revenue. This investigation and the proposal to revamp depletion allowances in various branches of the industry, as in the case of silver, were the principal matters commanding attention today, with respect to mine taxation. At present, he said, it looked as if the industry would get nothing at all under depletion allowances. He then introduced Representative Joe J. Manlove, of Missouri, and a member of the House Committee on Mines and Mining.

Mr. Manlove's topic was "Federal Tax Legislation." The expenses of government must be met, said he. Who should pay? What should be the basis of levy? So long as the burden was justified and evenly distributed, there was no complaint. What were the legitimate burdens? he asked, and where and how should they be met? It was natural to ask this today, when taxation seemed ever on the increase, he said. Appropriations in the second half of the sixty-eighth Congress were almost four billion dollars, the public debt was huge. There was no complaint as to individual outlays. The budget system had reduced the general running expenses of government. How was the money to be raised?

The speaker discussed the discovery and depletion allowances to the mining industry under the revenue law and commended the statements of zinc and lead producers of Missouri, Oklahoma and Kansas to the House Committee on Ways and Means in behalf of continuing these allowances. "There must be a continuous discovery of new zinc and lead orebodies to take the place of the short-lived mines which are exhausted," he said. "It is highly proper that concessions should be made to those willing to take the hazard of the uncertain undertaking."

Mr. Manlove urged the mining men to consider the severance taxes which are established in Minnesota and which have been proposed in Missouri. He described these proposals as attempts "to fasten upon the products of mines a tax upon gross production." He indicated his opposition to the capital-stock tax on the ground that a struggling mine-development company should not pay a tax cumulative year by year on a natural resource which should be conserved in keeping with the demand.

Mr. Manlove approved the decentralization plan of the Revenue Bureau to relieve the heavy expense incident to the settlement of tax disputes in Washington. He said it should be the policy of the government that in separating a man from his money the operation should be made as painless as possible. Reluctant as the taxpayer was to part with his money, he said, it was a small worry compared with the dispute as to how great the tax was to be.

Taxation and general prosperity were closely allied, the speaker said. Overburdensome or duplicated taxation might break some of the cogs in the wheel of prosperity. As to overproduc-

tion, which was not difficult to reach in the zinc industry he said, the anti-trust law forbade combinations to restrict production. Operators know that natural resources must be conserved.

Few Changes in New Measure

Following Mr. Manlove, George R. Holmes, of New York, discussed those provisions of the new Revenue Bill that are applicable to mines. On the whole, the bill was a commendable piece of work, he said. Changes of interest to mining men were very few.

Regarding depletion, it was not at all certain that the provision relating to discovery depletion would be in the law when passed, he said. There was much hostility to it. Those with interests outside of mining were critical of it, he said, holding that it should never have been in the law. The mining industry should therefore keep alert and watch the course of the bill.

Various other clauses were pointed out and discussed by Mr. Holmes. The bill was as favorable as could be obtained under present conditions, he said, and he advised that no effort should be made to secure a change. One thing he urged: Section 1203 provided for the appointment of a joint committee on taxation to consist of five members from the Senate, five from the House, and five representing the public; the Mining Congress should endeavor to secure the appointment of an appropriate man as representative of natural resources, he said.

Industrial Relations and the Coal Situation

"The Mining Industry and Labor" was the general topic at the third session, on the morning of Dec. 10. H. N. Taylor presided. The Secretary of Labor, the Hon. J. J. Davis, spoke on "The Bituminous Industry as I See It." The primary evil of the industry was overdevelopment, he said. From 1900 to 1922, almost one and one-half billion man-days had been lost in the coal industry, only 14 per cent being due to strikes, however.

The Hon. James Murdock, of Ottawa, former Minister of Labor in the Dominion Government, in a talk on "The Protection of Public Rights in Industrial Disputes," described the working of, and the results obtained from, the Industrial Disputes Investigation Act of Canada. The act had gone far toward gaining the ends sought, he said.

The position of the anthracite operators was described by S. D. Warriner, president of the Lehigh Coal & Navigation Co. He told how peace, based on the award of the Roosevelt Commission in 1902, had prevailed in the industry for twenty years, and then how in 1922 this system broke down with startling suddenness when John L. Lewis, of the United Mine Workers, announced before negotiations had even been begun that, regardless of past practice, a strike would be called April 1, if by that time a new contract had not been signed. The union, he said, was a bituminous organization. The basic issue in the last three years, he said, had been the question of arbitration, which the operators had consistently urged and the union consistently opposed. The theory of commercial operation proposed by the Governor of Pennsylvania was impracticable, he said: it ignored important commercial factors and all legal restrictions imposed by federal statutes. As to possible federal legislation, he said, unless it could be proved that anthracite was an essential and could command at all times a monopoly price, the treatment accorded it should not differ from that given other mining and industrial enterprises. Out of this chaos, he said, operators believed would come an agreement embodying the "men and management" idea of industrial co-operation, with assured methods of adjusting disputes, and providing satisfying service to the public.

Standardization Committees Report

The Standardization Division of the Mining Congress, with Col. Warren R. Roberts as chairman, held its general meeting on Thursday afternoon. R. M. Hudson, chief of the Division of Simplified Practice of the Department of Commerce, spoke on the topics of simplification and standardization. Following this the annual report of the metal-mining branch of the Standardization Division was read. Less had been done in the past year than in other years, owing to the fact that many of the reports of committees had not been returned by the mining standardization correlation committee. It was announced that during the year Charles A. Mitke had resigned as chairman of the branch, but that his resignation had not been accepted and that it was hoped that it could be arranged to have him remain in charge.

Thirty-five years of experience with the anti-trust laws has conclusively established that it is folly to apply them to the natural resources of the United States, declared Gilbert H. Montague, of New York, in an address at the closing session. "Because of the fear of the anti-trust laws, throughout the production and distribution of our natural resources," he said, "employers are reluctant to engage in collective bargaining, operators are prevented from going into consolidations or co-operative arrangements that would prevent demoralization from excessive, high-cost operating units, and distributers are afraid to join in combinations and co-operative arrangements that might prevent duplicated, high cost distribution.

"Since Congress has already gone so far, in granting various exemptions from the anti-trust laws and the Federal Trade Commission Act to labor, agricultural and horticultural producers, railroads, bankers, shipping lines, insurance companies, telephone companies, packers, stockyards, planters, ranchmen, dairymen, and nut and fruit growers, Congress cannot reasonably deny similar relief to the producers and distributers of the natural resources of the United States.

"Should Congress delay its discharge of this clear duty, the federal courts may in time, as in the past, through the ever-growing 'rule of reason' in their interpretation of the anti-trust laws, accomplish a certain degree of relief. Recent Supreme Court decisions carry a strong intimation of this trend.

"Consolidations and combinations, bringing about less waste, greater stability, and real economies in the production and distribution of natural resources, are likely in the future to be more sympathetically viewed by the courts."

In talking on the question, "What is a fair wage for a miner?" Sidney J. Jennings, of the U. S. Smelting, Refining & Mining Co. and former president of the congress, said that the answer could not be a simple statement of an arithmetical nature. The best method of adjusting the struggle over the division of wealth produced was by a bargain between a company and its men.

Stabilization of the mining industry was discussed by Robert E. Tally, of the United Verde Copper Co.

Arbitration of Coal Strike Endorsed

A number of resolutions were adopted by the convention. The first, introduced by Sidney J. Jennings, had reference to the anthracite strike and endorsed the principle of settlement of industrial controversies by arbitration. Resolution No. 2, introduced by Charles S. Hurter, of the E. I. du Pont de Nemours company, approved the transfer of the Bureau of Mines from the Department of the Interior to the Department of Commerce.

The National Safety Competition now being conducted under the auspices of the Bureau of Mines was heartily indorsed in the third resolution, which was introduced by Ernest W. Merrill. Participation in the competition by all members was urged.

Efforts, heretofore made and proposed to be made, to require additional purchases of domestic silver in accordance with "the true intent and meaning of the Pittman silver act of 1918" were approved in the fourth resolution, which was introduced by the Western Division of the Mining Congress.

Less severe restrictions upon prospecting on grazing and agricultural lands and within national forests of the Western states was advocated in the fifth resolution, also introduced by the Western Division.

A resolution introduced by the Tax Division protested against the injury caused the mining industry by the secret method of procedure of the Senate Committee on Investigation of the Bureau of Internal Revenue. The proposal in the new Revenue Bill to create a joint commission on taxation, on which both of the houses of Congress and the public will be represented, was indorsed, likewise the non-partisan attitude of the Ways and Means Committee in preparing the pending bill.

Wentz Elected President

Succeeding Louis S. Cates as president, Colonel Daniel B. Wentz, of the Stonega Coal & Coke Co., Philadelphia, Pa., was elected to the highest office of the Mining Congress for the year 1926. Three vice-presidents were chosen: Robert E. Tally, United Verde Copper Co., Jerome, Ariz.; L. L. Doheny, Los Angeles, Calif.; and W. H. Lindsey, Napier Iron Works, Nashville, Tenn.

James F. Callbreath was re-elected Secretary of the organization. George B. Harrington, of the Wilmington & Franklin Coal Co., Chicago, was made a member of the board of directors.

Northwest Miners Would Change Many Laws

Enthusiasm at Spokane Meeting—Alaska Defended— Gray Sees Long Life for Coeur d'Alene

By Storey Buck

RESOLUTIONS of national importance and several of great concern to the Northwest were outstanding features of the thirtieth annual Northwest Mining Convention held in Spokane Dec. 1 to 5. Strong delegations attended the convention from a broader field than usual, particularly from Alaska, Seattle, Vancouver and southwestern Oregon, and their influence was felt throughout the deliberations. The display of ore samples was the best and most complete ever shown in Spokane, the East British Columbia Chamber of Mines alone contributing 275 specimens of new ore, most of them from recently opened properties of the Kootenays. This display was in charge of J. W. Mulholland, of Nelson. The exhibits were viewed by more persons than at any previous convention for many years.

The convention opened with a carefully prepared address on the probable continuation of the present heavy production of the mines of the Coeur d'Alene region by John P. Gray, of Coeur d'Alene, Idaho.

Mr. Gray said that though it is not probable that the production of lead in the Coeur d'Alenes will increase, it is to be expected that it will continue at about the present rate for a long period and the production of zinc in the district may increase. His belief in the continued lead production he attributed to the extension of development on known orebodies, improved metallurgy including refinement in the art of ore dressing, better recoveries, better separation, better crushing, grinding, and classifying, and better treatment.

A large number of resolutions were prepared by the resolutions committee, of which Joseph McCarthy, a Spokane lawyer, was chairman, and were adopted on the last day of the convention. One declares that all land still held by the federal government in California, Washington, Oregon, Idaho, Nevada, Utah, Arizona, New Mexico, Wyoming, Colorado, and Montana should be ceded to those states and that the area in those states held by the federal government is almost half their total area.

Other resolutions adopted were as follows:

That the Alaska Legislature should be empowered to legislate for its public lands as does the Philippine Legislature, which has authority over its lands, subject to the approval of the President.

That the law requiring prospectors to file a bond before they may go upon lands taken under the "Greater Homestead Act" be repealed and that no further lands be withdrawn from mineral exploration.

That the proposal to discontinue or tear up the government-owned railroad in Alaska would be nothing short of an economic crime to the nation and that the continued operation of the road is of paramount importance.

That the capital-stock tax, stamp tax on corporate certificates, and the corporate income tax be abolished.

That there be no curtailment of the mail service in Alaska or any of the Western states.

That the right to prospect and mine in any area hereafter set aside for parks shall not be withheld.

That the Legislature of Washington

J. P. Gray

reduce filing and license fees of corporations to the scale which prevailed before the present schedule was adopted, or to not over 25 per cent of the present fees.

That if any "blue-sky" law is enacted in Washington involving mining enterprises it should not go beyond the filing of instruments and documents giving such complete information as is provided in the laws of Idaho and Colorado.

That the Legislature be asked to complete the mines laboratory at the University of Washington.

That the Washington Legislature enact into law the recommendations of the State Tax Commission for the classification of property.

That Washington establish a state department of mines as recommended by the Seattle Mining Club which should function somewhat as do the mining departments of California and British Columbia.

That a bureau of geology, topography, and hydrography be established in Washington.

A. L. Hooper, president of the Northwest Mining Association, under the auspices of which the convention was held, presided at the regular meetings and there were special chairmen for the programs given to each district or state. Frank C. Bailey, secretary of the Northwest Mining Association, was manager of the convention.

Falcon Joslin, of Seattle, was chief speaker at the banquet Wednesday evening given by the Spokane Chamber of Commerce to the delegates. He spoke on Alaska, which he said could not have been worse administered by the federal bureaus in the last 20 years if it had been governed by a board of directors selected from an insane asylum.

"Conservation has strangled several great industries which would otherwise have developed into as much importance as those of mining and salmon fishing," said Mr. Joslin. "Conservation is the highbrow name for socialism, and socialism does not work any better in Alaska than in Russia. Conservation believed in the feudal system where the government owned all the land, which was tilled by serfs. It is a system invented by bureaus in Washington to increase their powers. The bureaus which attempt to preserve the timber of Alaska have permitted four million feet of its timber to rot since they have been in control. During that period the population has decreased from 40,000 to about 22,000. If the territory had been allowed to grow it would have a million people today and its production would be a billion dollars a year instead of $100,000,000."

Charles D. Garfield, of Anchorage, said that the federal supervision of Alaska has been on principles contrary to all American ideas of progress and development. Speaking of placer mining in the territory, Maurice D. Leehey, of Seattle, said that if cold water thawing of placer ground proves as successful as the experiments indicate, Alaska's gold production in the future will be greater than it has been in the past and gold mining there will repeat the history of gold mining in California.

A. G. Langley, resident engineer of Revelstoke, presided on British Columbia day, and Dr. Victor Dolmage, of Vancouver, a member of the Canadian Geological Survey, brought the official greetings of the British Columbia Chamber of Mines of Vancouver. He spoke of the cordial friendship between British Columbia and the northwestern states and said that mining conditions were quite similar, due to the fact that the geology was much the same and the two countries have the same mountain ranges, the same rivers, and much the same climate "except that it is drier south of the line."

A. J. Dunn, editor of the *Wallace Miner*, reviewed mining in the Coeur d'Alenes and said that the Bunker Hill, Morning, Hecla, and Gold Hunter have been producing from twenty-five to forty years with a heavier output now than ever before.

A. M. Piper and Virgil R. D. Kirkham, of the Idaho School of Mines, spoke, and Robert N. Bell, former mine inspector of Idaho, said that a satisfactory tonnage is being developed at the Red Bird mine, in Idaho, recently acquired by Henry Ford interests, and that it is anticipated development will be continued by the erection of a plant.

H. E. Hendryx, a newspaper man of Baker, presided on Oregon day, and the reviving mining interests of that state were well presented by Dr. D. C. Livingston, of the School of Mines of the Oregon Agricultural College, by P. S. Woodin of Grants Pass, secretary of the Oregon Mining Survey, and by other speakers. Dr. Livingston said he has spent a good deal of time in the copper belt along the Snake River in Oregon, and he expressed the opinion that several mines of importance will be developed in that district.

Recent Technical Publications

Reviews, Abstracts, and References

The World's Tin Resources

Tin Fields of the World. By William R. Jones. Mining Publications, Ltd., London, E. C. 2. Price, 30s.

The tin industry of the world is in a state of flux: The alluvial and eluvial deposits of southeastern Asia, from which most of our tin has so far come, are gradually becoming exhausted, though their life has been extended by the utilization of modern equipment, chiefly bucket dredges, which has made the recovery and treatment of low-grade material economically possible. In the not far-distant future the world must get most of its tin from primary deposits, in all probability, thus duplicating the history of gold mining in this country. The rise of Bolivia as a tin-producing country is thus foreshadowed, though other districts are likely to be heard from as the production of the Far East dwindles. A book on this subject is therefore timely, particularly as no general book on tin has been published in twenty years, according to the author.

The first chapter introduces the reader to the metal, giving briefly its properties, uses, and certain statistics. It is refreshing, in a book issued around the first of December, to be able to find the average price of tin as late as the preceding September. Some of the other tables, however, omit later statistics than those for 1922 or 1923—statistics which have been obtainable for several months. The second chapter is devoted to tin smelting, a subject with which the author is evidently not familiar or has had difficulty in getting information released. His description of the reverberatory smelting of tin ores is taken from a Tasmanian government report dated 1900. A list of the tin smelters of the world, with their capacities, would have been welcome here. Then comes a chapter in which is included a short account of the methods of marketing tin ores and concentrates, and Chapter 5 covers tin-mining methods in a more satisfactory manner than smelting is covered. The remaining chapters of the book are devoted to descriptions of the various deposits of the world, covering not only their geology, but also discussing technical methods of ore extraction and treatment, and economic conditions. Much of this part of the book is, of course, a compilation, but the author has seemingly done his job well, and has contributed liberally from the fund of his experience. A good bibliography is appended and the index is more complete than usual.

This book will be found to contain much of interest to all those engaged in the tin industry; from the prospector, who will find that there is little use looking for tin in any regions except those containing granitic rocks, and that probably he will not find any even there; to the consumer, who is concerned about his supplies of tin a few years hence. E. H. ROBIE.

Mathematical Tables — Longmans, Green & Co., 55 Fifth Ave., New York City, have issued, at 40c., a pamphlet of "Four-Figure Mathematical Tables," compiled by G. W. C. Kaye and T. H. Laby. Included are: Logarithms, antilogarithms, five-figure logarithms, reciprocals, squares; natural sines, cosines, and tangents; logarithmic sines, cosines, and tangents; degrees to radians; and powers, roots, and reciprocals. The tables are well arranged.

California Gold — The geology and ore deposits of the Randsburg district, in California, are described in detail by Carlton D. Hulin in Bulletin No. 95, 148 pages, obtainable for $2 from the State Mining Bureau, Ferry Building, San Francisco, Calif. Tungsten, gold, and silver are the principal metals of economic importance found in the district, California Rand Silver now being the principal producer. The report is cloth bound and contains a geological map in colors.

Economic Geology — The November issue of *Economic Geology* (Lancaster, Pa.; price 65c.) contains the following articles: "Oxidation Products Derived from Chalcopyrite," 27 pages, by R. Blanchard and P. F. Boswell; "New Kind of Metamorphism and Ore Deposits," 5 pages, by A. N. Winchell; "Geology of the Etta Spodumene Mine, South Dakota," 15 pages, by G. M. Schwartz; "Formation of the Porcupine Quartz Veins," 12 pages, by E. Y. Dougherty; and "Bauxite Deposits of Southeastern Alabama," 17 pages, by R. E. Rettger. The December number contains: "Structural Unity of Pacific Region; Evidence of Ore Deposits," 17 pages, by E. C. Andrews; "Mineral Resources of Maranhao, Brazil," 7 pages, by E. W. Shaw, W. H. Wright, and J. L. Darnell, Jr.; "Electrical Conductivity of Ore Minerals," 10 pages, by P. F. Kerr and C. K. Cabeen; "Physical Chemistry of the Calcium Sulphates, and Gypsum Reserves," 9 pages, by O. Bowles and M. Farnsworth; and "Origin of Ore of Mansfeld Kupferschiefer, Germany," 17 pages, by P. D. Trask.

Ball and Roller Bearings — The *Journal* of the South African Institution of Engineers for October (price 2s.; Johannesburg) contains a 17-page paper by William C. Massie on "Ball and Roller Bearings." The author outlines briefly the development of the most prominent designs, indicating the advantages of each for certain duties, and says that "there are now very few applications in which ball or roller bearings have not proved themselves more economical and satisfactory than the plain slide bearing, and the latter will in time become as rarely met with in general engineering as it is now in automobile work."

Geological Survey—The annual report of the Director of the U. S. Geological Survey for the year ended June 30, 1925, 91 pages, is now obtainable on request.

Colorado Geology — Travelers over the narrow gage of the D. & R. G. R.R. between Montrose and Salida are familiar with the Black Canyon of the Gunnison River. The geology of this entire region is discussed in U. S. Geological Survey Bulletin No. 777, "Pre-Cambrian Rocks of Gunnison River, Colorado," 94 pages, by J. Fred Hunter. A geologic map is included. Copies are obtainable from the U. S. Geological Survey, Washington, D. C.

Sulphur — The June issue of the *Proceedings* of the Australasian Institute of Mining and Metallurgy, Melbourne, contains an 18-page paper on the "Sulphur Deposits of New Zealand," by Edmund B. Dow. The deposits "are small and isolated and do not warrant the attention of any large commercial undertaking, and, even if worked by small parties, the sulphur produced cannot compare in purity and price with the American product. The American deposits are of great size, the sulphur-bearing beds averaging 100 ft. in thickness at an average depth of 450 ft. below the surface. The Frasch process is now operating on beds containing about 60 to 70 per cent sulphur, producing a final product of 99.9 per cent sulphur. Production costs are low, and this sulphur is capturing the world's trade, even ousting Sicilian sulphur from adjacent European countries, in spite of certain agreements that these countries were not to be exploited."

Lead Refining — The bulletin mentioned in the preceding paragraph also contains a 51-page paper by G. K. Williams on "The Determination of Certain Curves and Their Application to the Desilveration of Lead by the Parkes Process." The paper is a result of a study of the Parkes process with a view of determining the interdependence of the variables (1) quantity of zinc required per charge; (2) temperature of stirring of each zincking; (3) silver content of the bullion after first zincking; (4) silver content of the bullion after second zincking; and (5) silver grade of the crusts produced for retorting. The possibility of effecting improvements in the Port Pirie practice of desilverizing was studied, especially with respect to the silver grade of the crusts produced for retorting and the quantity of zinc required per charge.

Australian Geology—The March issue of the *Proceedings* of the Australasian Institute of Mining and Metallurgy, Melbourne, contains a 28-page paper on "The Geology and Ore Deposits of Mount Stewart, Leadville, N. S. W.," by T. L. Willan. The minerals present are blende, pyrite, and galena. Three intrusions in the Silurian sedimentary slates and limestones of Mount Stewart are noted: The earliest is a mass of granophyre, the second a quartz-feldspar porphyry, and the third a pyrite-bearing granodiorite.

Interior Department—A brief review of the activities of the U. S. Department of the Interior, and of its problems, during the last year has been published. It is entitled "A 1925 Review of the Department of the Interior," and may be obtained on request to the Department at Washington, D. C.

Men You Should Know About

A. J. McNab, president of the Magma Copper Co., is visiting the company's property in Superior, Ariz.

J. C. Brumblay, traffic manager and ore buyer for the Mason Valley Mines Co. in Nevada, is in San Francisco.

O. M. Tupper, Jr., has been made superintendent of the new plant of the Clay Corporation of California at Lincoln.

A. T. Powell has been appointed manager of the Quebec Testing Laboratories at Rouyn, in succession to **T. S. Gilchrist.**

Louis Franklin, consulting geologist and valuation engineer, has opened offices in the Bob Waggoner Building, Wichita Falls, Tex.

Henry M. Rives, secretary of the Nevada Mine Operators' Association, has returned to Reno from San Francisco and other Coast points.

H. D. Budelman, mine superintendent for the West End Consolidated Mining Co. at Tonopah, Nev., has returned to Tonopah from San Francisco.

Colonel A. E. Humphreys, president of the Humphreys Oil Corp., and **Frank Cox,** vice-president, of Denver, Colo., were in Houston, Tex., recently.

Donald F. Irwin, of the Oliver Continuous Filter Co., of San Francisco, recently left for a two weeks' trip through central and southern Mexico.

Walter R. Vidler, of San Francisco, recently left Porcupine, Ontario, for Philadelphia, after concluding a season's field work in Gowganda and other Ontario mining districts.

R. W. Woods, of Vancouver, B. C., president of the Premier Gold Mining Co., has been visiting the properties of the Peerless Mining Co., at Stockton Hill, near Kingman, Ariz.

H. Vincent Wallace, manager of the Palisades Mines Co., Calistoga, Calif., has been recently in San Francisco completing arrangements for the installation of cyanide equipment.

Fred L. Cole, manager for the Cole interests at Tonopah, Manhattan, and Round Mountain, Nev., has returned to Tonopah from an examination trip into Grass Valley, Calif., territory.

George A. Kervin, formerly with the U. S. S., R. & M. Co., at Kennett, Calif., has been appointed smelter superintendent of the Thompson smelter of the Mason Valley Mines Co. at Wabuska, Nev.

C. E. Williams, formerly metallurgist with the U. S. Bureau of Mines, is now in the San Francisco office of the Columbia Steel Corporation, where he is engaged in research work for the company.

F. P. Osler, engineer for the Consolidated Mining & Smelting Co. of Canada, has been for some time in the Goudreau mining area of Ontario examining various properties on behalf of the company.

Weld & Liddell, consulting engineers, New York, have been engaged to make a reconnaissance of the iron ore possibilities of a large tract of land in Virginia. This work will be under the direction of C. M. Weld.

W. A. Leddell, formerly of Denver, Colo., is now mechanical engineer in charge of the design of the new mill and power house for the Compañia de Inversiones del Oro, S. A., at Sombrerete, Zacatecas, Mexico.

John W. Sherwin, general manager for the West End Consolidated and affiliated companies, has just finished an inspection of local operations of the West End, at Tonopah, and the Mabel mine, near Mina, Nev.

J. E. Spurr

J. E. Spurr, editor in chief of *Mining Journal-Press,* and **A. H. Hubbell,** managing editor, attended the meeting of the American Mining Congress at Washington last week. A staff report of the meeting appears on page 990 of this issue.

E. S. Gordon, who for the last twenty-five years has been closely identified with the mining industry in South Africa and northern Ontario, has joined the brokerage firm of Newman Sheaff & Co., of Montreal.

W. R. Lindsay, general superintendent of the Engels Copper Mining Co., has resigned to accept a similar position at the Granby company at Anyox, B. C. **W. I. Nelson** has been advanced to Mr. Lindsay's position at Engels.

K. I. Marshall, field engineer for the Western Precipitation Co., of Los Angeles, has just returned from Spokane, where he installed a small Cottrell plant in the mill of the Spokane Plastic Magnesite Co., at Meade, Wash.

J. W. Swaren announces the opening of an office in the Peoples Life Insurance Building, Washington, D. C., for consultation in the preparation of engineering data to be submitted before governmental departments and bureaus.

John A. McCarthy, of the United Metals Selling Co., an Anaconda subsidiary, returned from Europe on the "Berengaria" on Dec. 4, and **C. F. Kelley,** president of the Anaconda company, followed him on the "Homeric" on Dec. 9.

J. B. Haffner, who for many years has been general superintendent for the Granby company at Anyox, has resigned, and is leaving soon for Mexico. He will be succeeded by **W. R. Lindsay,** of Englemine, Calif. Mr. Lindsay is a graduate of the University of Washington and has had considerable practical experience in Alaska.

W. F. Nash, chief clerk of the New Cornelia Copper Co. since its beginning, has resigned his position and **George Purcell,** assistant chief clerk, has been appointed to succeed him. Mr. Nash had been continuously in the employ of the Calumet & Arizona Mining Co. interests since 1906, having been an accountant connected with the Bisbee office until transferred to Ajo as chief clerk.

Gerald R. Simpson, of the Simpson Engineering Co., of Long Beach, Calif., has just returned from a trip to the property of the Kaaba Mining Co., at Kingman, Ariz., for the purpose of inspecting the mine and advising in respect to the installation of Simpson pneumatic flotation cells and other equipment in the 100-ton mill which is to be put into operation in the near future.

Stanley R. Moore, mining engineer, has returned from Alaska to his home in Wallace, Idaho, where he will spend the winter. Mr. Moore has charge of development of the Liberty Bell property, in the Bonnifield district, about 10 miles from the government railroad and 100 miles south of Fairbanks. The ore is arsenical pyrite, having an average gold content of from $6 to $8 per ton, which with the high percentage of arsenic promises substantial profits.

Obituary

Leonard Warmington, for many years shift boss and foreman at the Copper Queen branch of the Phelps Dodge Corporation in Bisbee, Ariz., died recently in that city.

Captain James T. Smith, mining man, soldier, and dean of newspaper men of the Rocky Mountain states, died on Dec. 1, at Denver, Colo. Captain Smith was seventy-nine years old. He was one of the founders of the Colorado School of Mines. At the time of his death he was mining editor of the *Rocky Mountain News.*

Patrick Riordan, one of the pioneers of the Verde district, in Arizona, and one of its most highly esteemed citizens, died at Jerome, early in December. Mr. Riordan was born in County Kerry, Ireland, in 1869, and came to the United States in his early youth. After visiting the east and California he came to Jerome twenty-six years ago, and entered the employ of the United Verde Copper Co. He was a shift boss for several years and later became a mine foreman. It is said of him that he "started at the glory hole and climbed the ladders down to the 1,800 level." His entire active life was spent in the service of the United Verde Copper Co.

The Market Report

Copper Not So Active, but Price Is Firm

Other Non-ferrous Metals Show Little Change From Last Week, Except Tin, Which Is Off 2c., and Silver

New York, Dec. 16, 1925.—Sales of copper have been in much less volume than last week, but producers seem satisfied and have not cut prices further. In fact, most quotations reflect a slight advance. Lead and zinc have sold in fair volume at practically unchanged prices. London prices of tin declined, which induced buying here, but not sufficient to absorb all the offers. Silver is off about 1c. from last week, but the weakness appears to be temporary.

Copper Price Seems Stable

The extremely large buying of last week seems to have taken most of the pressure off from the market, and no effort has been made to sell below the 14c., delivered, level. In fact, the price today, as quoted by practically all producers, is 14¼c. for Eastern deliveries. A considerable amount of business might have been placed at 14c., but apparently no seller was willing to come to that figure, though a satisfactory amount of business at 14c. was done earlier in the week. Yesterday and today have been unusually quiet.

There is little demand for December, all consumers apparently being well taken care of for their current requirements.

The decrease in stocks reported on Saturday was encouraging to sellers, and emphasizes the enormous domestic consumption. However, it is felt that foreign demand must improve markedly before much of an advance in price can be expected. In this last week, the foreign market has continued quiet. American agencies are quoting in the neighborhood of 14.30c., c.i.f., though dealers and second hands are taking most of the business at 10 or 15 point concessions from this figure. An increasing tendency has been noted recently to buy copper for foreign delivery at *Mining Journal-Press* refinery prices plus a fixed charge for delivery abroad, and several contracts have been written on this basis.

Lead Still at 9¼c.

The lead market shows little change from last week. The contract price of the American Smelting & Refining Co. continues at 9¼c., New York, and offers are fairly free from most sellers at that level, though there is not a great amount of December lead still to be sold. On shipment from the Middle West, prices are somewhat higher, owing to the narrow differential between the St. Louis and the New York markets, and the 35c. per 100 lb. freight rate. On the other hand, forward lead, smelted from imported ore, can be sold at concessions. A small amount of January lead has been sold on a basis of 9.15@9.20c., New York, for example, and even less might be accepted for February.

In the Middle West, the level set last week by the principal interest, 9.15c., was shaded on Thursday by others, as was intimated in this report a week ago, and selling of even prompt lead has been general all week at 9.10c. A moderate amount of business has been done. A small tonnage of January lead was sold at 9c., St. Louis, but the amount was unimportant. Consumers throughout the country show little interest in buying for shipment later than December, even at concessions, evidently feeling that the price is more likely to go down than up, though fundamental conditions are so good in the lead industry that no important decline is to be expected; certainly not in January, a month in which the trend, in recent years at least, has been upward.

Daily Prices of Metals

Dec.	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N.Y.	St. L.	St. L.
10	13.775	62.125	63.125	9.25	9.10	8.60
11	13.775	62.00	63.00	9.25	9.10	8.60
12	13.775	62.00	63.00	9.25	9.10	8.50
14	13.775	61.00	62.00	9.25	9.10	8.50
15	13.775	60.25	61.25	9.25	9.10	8.50
16	13.80	60.25	61.25	9.25	9.10	8.50
Av.	13.779	61.271	62.271	9.25	9.10	8.533

*The prices correspond to the following quotations for copper delivered: Dec. 10th, 11th, 12th, 14th and 15th, 14.025c.; 16th, 14.05c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

Dec.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
10	59¼	60¼	65¼	285	279	34 3/16	34	38	37 3/16
11	59¼	60¼	65½	283½	278¾	34¼	34 1/16	37 11/16	37
14	59⅛	60¼	65¼	279¾	276¼	34	33⅞	37½	36 13/16
15	59	60	64¾	275¾	272¼	33 1/16	33¾	37⅛	36½
16	59¼	60¼	65	276	272¾	34 5/16	34 3/16	37¾	37

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Dec.	Sterling Exchange "Checks"	Silver		Gold London	Dec.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
10	4.84⅝	69⅛	32	84s11½d	14	4.84½	69	31¾	84s11½d
11	4.84⅝	69⅛	31⅞	84s11½d	15	4.84⅝	68⅜	31⅝	84s11d
12	4.84½	68¾	31 11/16	.....	16	4.84½	68¼	31 9/16	84s10¾d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cent premium.

New Machinery and Inventions

Many New Devices at Power Show

Progress Made in Machine Design Demonstrated by Numerous Exhibits—Increasing Importance of Pulverized Fuel Indicated by Various Types of Apparatus Introduced

THE progress made during the last twelve months, as reflected by the exhibits brought together at the Fourth National Exposition of Power and Mechanical Engineering in New York, was proof of the increasing importance of the part that power generation and use plays in modern industry. Among the novelties displayed were four new types of unit pulverizers for powdered coal, a new type of water-cooled furnace wall consisting of tubes to which were clamped carborundum-faced cast-iron blocks, several types of mechanically and electrically operated combustion-controlled systems, and a four-cylinder crankless engine.

Combustion apparatus occupied a large place. Boilers were of necessity shown mainly by working drawings; one display was that of a new single-pass boiler. One manufacturer showed a new form of forged-steel header. There were five showings of air-preheaters. Economizers were well represented.

The rapidly increasing importance of pulverized fuel was indicated by many exhibits of all types of apparatus used in its preparation and burning. These included pulverizers, feeders, transport systems, and burners. There was also a feeder and meter for delivering and measuring pulverized coal from storage bins to burners.

Numerous exhibits of hand- and power-operated stokers were shown. Oil-burning equipment was presented by eight manufacturers. Novelties in this field included burners for the use of either pulverized coal or oil. Great strides in perfecting schemes of combustion control were demonstrated by many excellent showings of new devices.

Developments in gages, meters, and recording instruments were mainly in the direction of securing instruments that are easier to read and in eliminating errors of reading and calibration. These instruments included all types of devices for measuring and recording the flow of air, steam and water, and temperatures and CO_2 content.

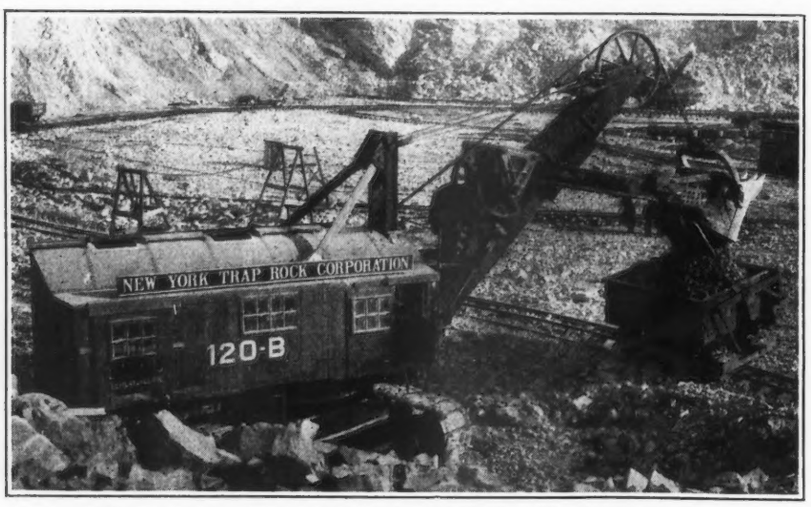
The advance in solving refractory problems was revealed in a series of highly interesting exhibits. Hollow furnace side walls for air cooling, the use of carborundum blocks, new cements, and simple methods for their application were among the displays.

In the accessory field there were many new developments. These included electrically operated soot blowers, non-collapsible float steam traps, safety stops for steam engines, air-cooled soot blowers, water columns, feedwater filters, regulators, pump governors and other technical apparatus.

The novelty among the exhibits of valves and fittings was a testing outfit for long-time duration test of metals under continuous load and at high temperatures. Short tests were in operation on cast chrome-nickel steel at 1,000 deg. F. under a load of 10,000 to 16,000 lb. per square inch. Valves for high pressures with several types of motor operation attracted attention in this class of exhibits.

Several large-size commercial steam turbine units were on exhibition. There were also several interesting showings of small steam turbines for direct-connecting or gearing to electric generators with ratings as low as 5 kw.

Exhibits of electric equipment included many types of direct- and alternating-current motors, a mercury arc-battery charging set, and several lines of switchboard and portable instruments, couplings, and underground conduit systems.



This new shovel is said to combine the advantages of the railroad-type and the full revolving shovels

Manufacturer's Achievements Summarized

"The Engineering Achievements of the Westinghouse Electric & Manufacturing Co. for the Year 1925" is the title of a 41-page summary of Westinghouse accomplishments that has just been received. It has been prepared under the direction of H. W. Cope, assistant director of engineering.

Center Drive Trucks Used on 1-Yard Shovel

The 1-yard A1 shovel made by the Thew Shovel Co., Lorain, Ohio, may now be had equipped with center-drive caterpillar trucks. The Thew drives four large wheels instead of two sprockets and at the middle instead of at the end. Spur gears are used instead of chain or bevel gears. The drive shaft does not carry any of the shovel weight as with the end drive types.

New Shovel Has Advantages of Railroad and Full-Revolving Types

Railroad-type shovels, long the most adequate digging tool in ore and rock, have always had certain inherent shortcomings, which resulted in the frequent installation of small revolving shovels on work which was unquestionably beyond their capacity, this according to the Bucyrus Co., South Milwaukee, Wis. The railroad-type shovel lacked mobility. It worked very close to the bank, and its digging and dumping radius was limited. On the other hand, the revolving shovel lacked the strength, power and capacity of the railroad-type shovel.

The Bucyrus 120-B is built to combine the advantages of both the railroad type and the full revolving shovel. This new shovel combines five qualities never heretofore found on one machine, according to the maker. They are:

1. The speed of action of the railroad-type shovel.
2. The mobility of single truck caterpillars.
3. The full revolving swing.
4. Big dipper capacity, 4 cu.yd.
5. Ruggedness and power greater even than the railroad-type shovel.

The machine has a dumping height of 20 ft. Its dumping radius is 36 ft. The boom is 29 ft. long and the rear end radius is 17 ft. The machine is designed and built with one purpose constantly in mind, that of building a machine which would be as free from interruptions in operation as it was possible to build. To this end all parts are made with a ruggedness much greater than in shovels formerly built.

The machine is planned for efficient operation and the steam machine includes features which are entirely new in steam-shovel design, such as firebrick arch and superheater as standard equipment. The electric machine is equipped with Ward-Leonard direct-current, generator-field control. It has been possible in the design of this machine to eliminate the necessity for compressed air.

Company Reports

Lake Shore Position Has Been Greatly Improved

A brief summary of the accomplishments of the last year by the Lake Shore Mines, Ltd., mining gold in the Kirkland Lake district in Ontario, is given by E. B. Knapp, the superintendent, as follows:

Mill tonnage for the year increased to approximately 9,000 tons monthly. The downward extension of No. 2 vein was proved on both the 800 and 1,000 foot levels. Ore was found in No. 1 vein, east of the shaft, on both the 800 and 1,000 foot levels. There was an increase of broken ore reserves of approximately 90 per cent both in tonnage and value.

The construction program has now been practically completed, and working costs were reduced by approximately 50 per cent.

During the year ended June 30, a total of 107,484 tons was mined and hoisted. Of this, 96,838 dry tons was ore, which was sent to the mill and treated. The remaining 7,582 tons of the entire production was waste, which was dumped on the surface.

The 96,838 tons of ore milled yielded bullion worth $1,812,494.66, the recovery per ton being $18.72. The tonnage milled during the year showed an increase of approximately 300 per cent over that of last year, and the bullion produced shows an increase of approximately 210 per cent or $1,334,252.07.

Construction for the year has been very heavy, due to the increased capacity of the mill. A new 2,000 cu.ft. air compressor, directly connected to a 350-hp. motor, has been installed in the power house. Two new 300-kw. transformers and the necessary switchboard equipment and connections have been erected. In the crusher plant a new No. 7½ gyratory crusher has been installed. The Crowe process has been put in the mill. A two-story tile refinery, 34 ft. by 40 ft., has been built, the upper story holding the precipitation presses. To insure adequate fire protection, a 600-g.p.m. centrifugal fire pump was installed. This is driven by a 150-hp. Sterling gasoline engine. The hydrants are so placed that any building on the property may be reached by the fire line. For general use a 50,000-gal. steel water tank has been erected, so situated as to provide maximum protection.

Profit-and-Loss Account for Twelve Months Ended June 30, 1925

Income			
Bullion production	$1,812,494.66		
Less exchange on bullion sales	486.61		
		$1,812,008.05	
Interest earned			
Dominion of Canada bonds	$9,826.46		
Other	1,634.03		
		11,460.49	
			$1,823,468.54
Expenses			
Operating			
Development, mining, milling, maintenance, general expense, and Ontario mining tax, after deducting sundry revenue		$697,352.37	
Administrative		17,729.28	
Provision for depreciation on buildings, structures and equipment		71,940.44	
Provision for exhaustion of mine		120,000.00	
Provision for dominion government taxes		57,711.53	
			964,733.62
Profit for period, carried forward, as set out on balance sheet attached			$858,734.92

Iron Cap Copper Cost 7.45c. per Pound

The Iron Cap Copper Co., according to a recently issued bulletin, during the third quarter of 1925 produced 766,677 lb. of copper, 32,255 oz. of silver, and 51 oz. of gold from its mines at Globe, Ariz. Income for the quarter was $104,789.26, against expense of $52,329.01, making a gain of $52,460.25 for the period covered by the report from which the figures were obtainable.

The net cost, including bond interest and taxes, without credit for other income, was 7.45c. per pound of copper on a grade of ore averaging 6.9 per cent.

Copper Supply Decreases 2,386 Tons

Domestic deliveries of refined metal have been the salvation of the copper market. These totaled 82,779 tons, according to the American Bureau of Metal statistics, November, compared with 76,000 tons in October and an average of 71,539 tons during the third quarter, which in turn was far higher than that of either of the preceding periods. Exports have been declining steadily since the second quarter, the total for November being 35,712, or 5,611 tons less than that for October. These figures appear in Table I, which shows also a decrease of 8,165 tons in production and of 5,017 tons in refined stocks as of Dec. 1.

On the other hand, stocks of blister at plants in North and South America increased during November from 245,001 to 247,632 tons, the net gain of metal above ground and as far as the blister stage being 2,386 tons.

Table II shows diminishing importance of England and Germany and increased shipments to France and Italy.

Table I—Refined Copper Production, Shipments and Stocks

Covering Refineries at Baltimore, Perth Amboy, Tacoma, Hubbell, Dollar Bay Houghton, Hancock, Laurel Hill, Raritan, Great Falls, Carteret and Chile. Bessemer Copper When Produced and Sold as Such Is Included.

(In Tons of 2,000 Lb.)

	Production	Shipments Export	Shipments Domestic	Shipments Total	Stock at End of Period
1919	927,604	(a)	(a)	684,182	351,061
1920	835,380	239,561	626,142	865,703	320,737
1921	537,197	282,706	307,260	589,966	267,968
1922	788,829	357,458	549,947	907,405	149,393
1923	1,163,885	421,872	735,521	1,157,393	155,885
1924					
First quarter	326,928	139,702	223,649	363,351	119,462
Second quarter	323,535	135,676	195,126	330,802	112,195
Third quarter	316,197	132,229	159,408	291,637	136,756
Fourth quarter	333,672	158,788	175,206	333,994	136,434
Totals	1,300,332	566,395	753,389	1,319,784	.....
1925					
First quarter	327,722	150,037	191,771	341,808	122,348
Second quarter	337,302	174,147	194,177	368,324	91,326
Third quarter	332,637	140,338	214,618	354,956	69,007
Third quarter average	110,879	46,779	71,539	118,318	.....
October	121,639	41,323	76,468	117,791	72,855
November	113,474	35,712	82,779	118,491	67,838
Totals	1,232,774	541,557	759,813	1,301,370	.....

(a) Not separately reported.

Table II—Copper Exports by Ports

	November, 1925 Tons	November, 1925 Per Cent	Jan.-Nov. 30, 1925 Tons	Jan.-Nov. 30, 1925 Per Cent
Canada	876	2.45	11,146	2.06
Mexico	.....	.....	389	.07
South America	.....	.....	571	.11
Belgium	3,028	8.47	41,772	7.71
Denmark	.....	.....	3,211	.59
England	4,688	13.13	106,042	19.58
France	9,889	27.69	85,796	15.85
Germany	5,609	15.71	141,958	26.21
Holland	1,418	3.97	47,771	8.82
Italy	8,310	23.27	73,111	13.50
Norway and Sweden	1,065	2.98	13,446	2.48
Spain	286	0.80	2,932	.54
Far East	543	1.53	12,506	2.31
Other	.....	.....	906	.17
Totals	35,712	100.00	541,557	100.00

Auction Sales of Mining Stock

The following mining securities were sold at auction recently in New York:

3,000 shares New York-Bingham Mining Co.	$110
200 shares Bagdad-Chase Gold Mining Co., pfd. and 100 shares Bagdad-Chase Gold Mining Co., com.	13
1,000 shares International Tungsten Corporation temporary certificates and 500 shares International Tungsten Corporation	12
1,000 shares the Cobalt-Lorrain Mining & Developing Co.	2
19,589 shares Santa Rosa Mining Co., com.	500
500 shares Kornkob Mining & Development Co.	2
6,050 shares Chontales Mines, Ltd.	310
45,000 shares California Nevada Copper	10
40,000 shares Ely Nevada Copper	11
2,000 shares Wyoming Gold Mining Co	13
$12,500 California Nevada Copper Co., 1st 7s, 1912, certificates of deposit	11
$21,471 50 demand note of the Manigotogan Mining & Development Co., Ltd., dated May 1, 1924	110
600 sub shares Colombian Emerald Syndicate, Ltd.	1
5,000 shares Central American Mines, Inc	210
6,250 shares Alta Corbin Mines	30
5,000 shares Oklahoma Oil Co. com., 500 shares Marigold Mining Co., Ltd., 303 shares the Dakota Continental Copper Co., 100 shares the Black Prince Copper Co., 10 shares Sonoma Magnesite Co., 300 shares Allied Oil Corporation	20
$124,000 The Imperial Copper Co. 6 per cent special contract mortgage registered bonds due July 1, 1918; $99,000 have installment coupons $50 each Nos. 1 to 20 attached; $25,000 have installment coupon $50 each Nos. 2 to 20 attached	25

Spot Zinc Still Scarce

The unusual range between the price of spot and forward zinc has continued or even increased. Sales have been somewhat better than last week, particularly of forward, the business being pretty well distributed over December, January, or February, with only two or three sellers having zinc available for the current month. Prices have held fairly constant throughout the week at the following levels: December, 8.70@8.75c.; January, 8.45@8.50c.; February, 8.35@8.45c.; and March, 8.30 @8.35c. The premium on Brass Special is about 20c. per 100 lb., and high-grade continues to sell at 10¼@10½c. delivered.

Statistics released last week by the American Zinc Institute are as follows:

	Tons
Stock, Nov. 1	7,475
Produced	50,629
Shipped	51,182
Stock, Nov. 30	6,922
Shipped from plant for export	3,318
Stored for customers	12
Retorts operating Nov. 30	90,085

Tin Declines 2c.

Tin prices have declined 2c., following the lead of London, and buying in the last two or three days has improved in consequence. Offerings have been free at the lower levels. Forward tin has sold at concessions of one-half to three-quarters of a cent from the prices for near-by. Spot tin is virtually unobtainable.

Silver Off 1 Cent

Heavy Chinese selling has caused a further break in the silver price, and without support from others the future of the market is dependent upon their attitude. These China sales of silver are reported to be a hedging operation against the purchase of Japanese yen, in which currency Chinese operators are said to have built up a long position.

Mexican Dollars: Dec. 10th and 11th, 53⅛c.; 12th, 52⅞c.; 14th, 53c.; 15th, 52½c.; 16th, 52⅝c.

Francs Weaken Further

Closing cable quotations on Tuesday, Dec. 15, were: francs, 3.5825c.; lire, 4.035c.; and marks, 23.81c. Canadian dollars, 1/32 per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 29c. per lb.; 98 per cent, 28c. London, 98 per cent, £118 per long ton.

Antimony—Per pound, f.o.b. New York: Chinese brands, spot, 21@22c. January, 20½@21½c. Cookson's "C" grade, spot, 22c. Oxide and needle antimony nominally unchanged from Dec. 5.

Bismuth—$3.25@$3.30 per lb., in ton lots. London, 12s. 6d.

Cadmium—60c. per lb. London, 1s. 9d.

Nickel—Ingot, 34c.; shot, 35c.; electrolytic, 38c. (99.75 per cent); London, £170@£175 per long ton.

Osmium—$110 per oz.; London, £23 10s.@£25 10s.

Platinum—$120 per oz. refined officially quoted. Sales also at $115@$118. Crude, $114@$114.75. London, £23 @£25 for refined; crude £20@£21½.

Quicksilver—Per 75-lb. flask: $90@ $91 for spot; forward, $88@$89. San Francisco $90.67. London, £15@£15¼.

The prices of Cobalt, Germanium Oxide, Iridium, Lithium, Magnesium, Molybdenum, Monel Metal, Palladium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of Dec. 5.

Metallic Ores

Manganese Ore—Per long ton unit of Mn, c.i.f. North Atlantic ports: Brazilian, 42@44c., nominal; Indian, 44c., nominal; Caucasian (unwashed), 42c.; Caucasian (washed), 44c.

Tungsten Ore—Per unit of WO_3, N.Y.: Wolframite, $11.50@$12.50; Western scheelite, $12@$12.75.

Chrome Ore, Galena and Pyrite Radio Crystals, Iron Ore, Molybdenum, Tantalum, and Vanadium Ores are unchanged from quotations in the Dec. 5 issue.

Lead Ore Lower—Zinc Blende Unchanged

Joplin, Mo., Dec. 12, 1925

Zinc Blende	Per Ton
High	$62.20
Premium, basis 60 per cent zinc	$57.00@$58.00
Prime Western, 60 per cent zinc	$56.00
Fines and slimes, 60 per cent zinc	$55.00@$51.00
Average settling price, all	$57.85
Galena	
High	$126.80
Basis 80 per cent lead	$115.00
Average settling price, all	$124.91

Shipments for the week: Blende, 16,093; lead, 3,114 tons. Value, all ores the week, $1,319,890.

Buyers are making no especial effort to purchase a large tonnage, and are generally accepting whatever tonnage is offered by those mines within the school districts in Oklahoma, where taxation was advanced to approximately $2.50 per ton of concentrates. The state supreme court upheld the contention of the schools. The tonnage contracted today was 11,000 and last week 10,000 tons, the two weeks' purchase exceeding one week's output by only 4,000 tons. In the two weeks 33,000 tons of zinc concentrate was produced and buyers contracted for 21,000 tons of it.

Platteville, Wis., Dec. 12, 1925

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$58.50
Lead Ore	
Lead, basis 80 per cent lead	$120.00

Shipments for the week: Blende, 1,379 tons; lead, 40 tons. Shipments for the year: Blende, 46,502; lead, 2,251 tons. Shipments for the week to separating plants, 1,998 tons blende.

Non-Metallic Minerals

Amblygonite, Andalusite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from prices in the Dec. 5 issue.

Mineral Products

Arsenious Oxide (White arsenic)—3¼c. per lb. Only an occasional carload sold. Some sellers asking 3½c., but for a good tonnage, 3c. could probably be done. London, £14½@£15 per long ton.

Copper Sulphate, Sodium Nitrate, Sodium Sulphate, and Zinc Oxide are unchanged from prices in the Dec. 5 issue.

Ferro-Alloys

Ferrocerium, Ferrochrome, Ferromanganese, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and Ferrovanadium are unchanged from the prices in the Dec. 5 issue.

Metal Products

Rolled Copper—Sheets, 22⅜c.; wire, base price, 16c. per lb.

Lead Sheets—Full, 13½c. per lb.; cut, 13⅜c..

Nickel Silver—29½c. per lb. for 18 per cent nickel Grade A sheets.

Yellow (Muntz) Metal—Dimension sheets, 20⅜c. per lb.; rods, 17⅜c.

Zinc Sheets—12c. per lb., f.o.b. works.

Refractories

Chrome Brick, Firebrick, Magnesite Brick, Silica Brick, and Zirkite are unchanged from prices in the Dec. 5 issue.

Steel Strong—Pig Iron Dull—Coke Lower

Pittsburgh, Dec. 15, 1925

The steel market is fully as strong as at any time recently, but the turnover is lighter, in keeping with the time of year. There is some contracting for first quarter, but much of the business was done last month.

The Steel Corporation's unfilled obligations increased by 472,597 tons in November, making 1,068,977 tons increase in three months, since decreases ceased.

The rate of steel production increased in November and the rate is now being held, indicating about 44,000,000 tons of ingots for the year, between 1 and 2 per cent above production in 1917 and 1923, thus far the highest two years.

The steel-buying movement of the last four months is considered particularly healthy and especially promising of continuance, indicating sustained heavy operation of mills for a longer period than has lately been usual.

Pig Iron.—All pig-iron markets are dull. Bessemer, $21; basic, $20; foundry, $20.50, f.o.b. Valley furnaces.

Connellsville Coke—There is a further decline, blast-furnace lots of spot being available at $3.50. Furnaces showed no interest in first-quarter contracts at $4.25, and now there are some offerings at under $4.

Mining Stocks—Week Ended December 12, 1925

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	49⅝	48⅝	49	Oc.17,No.23,Q	0.75
Arcadian Consol.	Boston	*75	*75	*75		
Ariz. Com'l	Boston	13	12½	12⅝	Jy.21, Jy. 31 SA	0.50
Calaveras	N. Y. Curb	4	3⅞	3⅞		
Calumet & Arizona	New York	57	54½	56¼	De.4, De.21 QX	1.50
Calumet & Hecla	Boston	14¼	13⅝	13⅞	Nov 30,De.15 Q	0.50
Cerro de Pasco	New York	63⅝	61½	62	Dc.10, De.22,X	1.00
Chile Copper	New York	34½	34	34	Dec.2, Dec.28, Q	0.62½
Chino	New York	20¼	19⅜	19⅜	Sept., 1920	0.37½
Con. Coppermines	N. Y. Curb	2	1⅞	1⅞		
Copper Range	Boston	20	18½	18⅝	May, 1925	1.00
Crystal Copper	Boston Curb	*50	*46	*47		
East Butte	Boston	4	3 11/16	3¾	Dec., 1919	0.50
First National	Boston Curb			*18	Feb., 1919	0.15
Franklin	Boston	*80	*70	*70		
Granby Consol	New York	21⅞	20⅛	20⅛	May, 1919	1.25
Greene-Cananea	New York	13⅜	12⅛	12⅜	Nov., 1920	0.50
Hancock	Boston			*50		
HoweSound.new,r.t.c.	New York	29	27¼	28⅜	Oc.5, Oc. 15 Q	0.50
Inspiration Consl.	New York	26⅛	26	26	De.17, Ja.4, Q	0.50
Iron Cap	Boston Curb	2⅜	2⅛	2⅛	May, 1923	0.15
Isle Royale	Boston	12⅜	11⅝	11⅝	No.30, De.5	1.00
Jerome Verde Dev.	N. Y. Curb	1.00	*95	1.00		
Kennecott	New York	55¼	53⅞	54⅛	De.4,Jan.2 Q	1.00
Lake Copper	Boston			1⅜	June, 1925	0.50
Magma Copper	New York	43½	42⅞	43½	Oct.1, Oct.15,	0.75
Mason Valley	N. Y. Curb	1⅞	1½	1⅝	Nov., 1917	1.00
Mass Consolidated	Boston	*50	*50	*50	Nov., 1917	1.00
Miami Copper	New York	12⅜	11⅜	12	No.2, No.16 Q	0.25
Mohawk	Boston	33	32⅛	32⅛	Oc.31, De.2	1.00
Mother Lode Coa.	New York	7⅞	7⅛	7⅛	De. 11, De. 31	0.37½
Nevada Consol	New York	13⅞	13⅛	13⅜	De. 18, De.31Q	0.25
New Cornelia	Boston	19⅝	18	19⅛	No.6, No.23 Q	0.25
North Butte	Boston	3¼	3	3	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*80	*75	*78	No. 14, De. 2	0.05
Old Dominion	Boston	18	17	18	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†126	†122		Se.19, Oc.2 Q	1.00
Quincy	Boston	22⅛	21⅛	21⅛	Mar., 1920	1.00
Ray Consolidated	New York	12⅜	12⅛	12⅛	Dec., 1920	0.25
Ray Hercules	N. Y. Curb			14		
St. Mary's Min. Ld.	Boston	36	35	36	May, 1925	3.00
Seneca Copper	Boston	10⅜	10	10⅛		
Shannon	Boston	*55	*55	*55	Nov., 1917	0.25
Shattuck Arizona	New York	6½	6⅛	6⅛	Jan.,1920	0.25
Superior & Boston	Boston	1	*99	*99		
Tenn. C. & C.	New York	16	14⅛	14⅛	De.31, Ja.15,Q	0.25
United Verde Ex.	N. Y. Curb	27	26⅜	27	Oc. 6, Nov. 20	0.75
Utah Copper	New York			111	De.18, De.31, Q	1.25
Utah Metal & T.	Boston	*70	*60	*60	Dec., 1917	0.30
Victoria	Boston	*50	*40	*40		
Walker Mining	Salt Lake	1.70	1.50	1.52½		
NICKEL-COPPER						
Internat. Nickel	New York	47½	44⅝	45	De.17,De.31,Q	0.50
Internat. Nickel, pfd.	New York	101	100⅝	100⅞	Oc.15, No.2, Q	1.50
LEAD						
Gladstone M. M. Co.	Spokane	*30	*28⅜	*29½	No. 1, No. 10 M	0.01
National Lead	New York	169	164	164½	De.11, De.31 Q	2.00
National Lead pfd.	New York	116⅜	116⅜	116⅜	Aug.21, Se.15	1.75
St. Joseph Lead	New York	47⅛	44⅜	44½	Nov.10,De.21Q	1.05
ZINC						
Am. Z. L. & S.	New York	10⅞	9⅝	9¾	May., 1920	1.00
Am. Z. L. & S, pfd.	New York	44½	38⅝	42	Nov., 1920	1.50
Butte C. & Z.	New York	7⅛	6⅜	6½	De.10, De.24	0.50
Butte & Superior	New York	18½	16¼	16½	De.15, De.31 Q	0.50
Callahan Zn-Ld	New York	2½	2	2	Dec., 1920	0.50
New Jersey Zn.	N. Y. Curb			214½	No.20,Dec.10X	2.00
United Zinc	N. Y. Curb	*74	*74	*74		
Yellow Pine	Los Angeles	*52½	*45	*48½	Se.10 Se.21 Q	0.04
GOLD						
Alaska Juneau	New York	2	1⅞	1⅞		
Argonaut	Toronto	*16½	*15½	*16		
Barry-Hollinger	Toronto	*25½	*24½	*25		
Carson Hill	Boston	*40	*30	*40		
Consol. W. Dome L.	Toronto	*18	*16⅜	*17		
Cresson Consol. G.	N. Y. Curb	2⅝	2⅜	2⅝	Se.30, Oc.10	0.10
Crown Reserve	Toronto	*22½	*20½	*22½	Jan., 1917	0.05
Dome Mines	New York	17⅞	17	17⅛	De.31, Ja.20, Q	0.50
Golden Cycle	Colo. Springs	†1.63	†1.60		No. 30, Dec.10 Q	0.03
Hollinger Consol.	Toronto	17.25	17.12	17.20	De.14, De.31	0.08
Homestake Mining	New York			47½	De.19, De.26 M	0.50
Kirkland Lake	Toronto	*80½	*75	*79½		
Lake Shore	Toronto	9.60	9.20	9.45	De.1,De.15 XQ	0.10
McIntyre-Porcupine	New York	22⅜	22	22	No.2, De.1 Q	0.25
Newray	Toronto	*40	*35	*38		
Night Hawk Pen.	Toronto	*7	*5½	*6		
Portland	Colo. Springs	†*65	†*63½		Oct., 1920	0.01
Rand Mines	New York	34⅛	34⅛	34½	Au.17, Au.25	1.52
Teck-Hughes	Toronto	2.48	2.33	2.44		
Tom Reed	Los Angeles	*61½	*55	*55	Dec., 1919	0.02
Tough-Oakes	Toronto	*53½	*50½	*52		
United Eastern	N. Y. Curb			*45	July, 1924	0.05
Vipond Cons.	Toronto	1.59	1.48	1.53		
Wright-Hargreaves	Toronto	7.90	7.45	7.80	De.15, Ja. 1 QX	0.10
GOLD AND SILVER						
Black Oak	N. Y. Curb			*81		
Carnegie Metals	Pittsburgh	18⅜	18½	18½		
Con. Cortez	N. Y. Curb	*6	*6	*6		
Con. Virginia	San Francisco	*13½	*12½	*13½		
Continental Mines	N. Y. Curb			*75		
Dolores Esperanza	N. Y. Curb	*74	*62	*74	July, 1923	0.05
Premier Gold	N. Y. Curb	2½	2 5/16	2⅛	De.18, Ja. 4	0.08
Tonopah Belmont	N. Y. Curb	*1⅛	*1 1/16	*1⅛	Se.15, Oc.1	0.05
Tonopah Divide	N. Y. Curb			*23	Oct., 1923	0.10
Tonopah Extension	N. Y. Curb	1 1/16	1 1/16	1 1/16	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	5⅛	4⅞	5	Se.30, Oc.21	0.07½
Unity Gold	N. Y. Curb			*50		
West End Consol.	N. Y. Curb	*26	*24	*26	Mar., 1923	0.05
Yukon Gold	N. Y. Curb			*50	June, 1918	0.02

Stock	Exch.	High	Low	Last		Last Div.
SILVER						
Alvarado	N. Y. Curb	*98	*75	*98	Oct., 1920	0.50
Beaver Consol	Toronto	*51	*40	*50½	May. 1920	0.03
Castle-Trethewey	Toronto	1.55	1.46	1.53		
Coniagas	Toronto	4.05	3.80	4.00	May, 1924	0.12½
Keeley	Toronto	1.67	1.54	1.65	Au.31,Se.15 X	0.12
Kerr Lake	N. Y. Curb	1⅜	1	1	Oc. 1, Oc.15 Q	0.12½
La Rose	Toronto	*40	*38	*39½	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	*8½	*7½	*8	Jy. 2, Jy. 15	0.05
McKinley-Dar.-Sav.	Toronto	*23	*19½	*22	Oct., 1920	0.03
Mining Corp. Can.	Toronto	3.30	3.06	3.28	Ja. 16, Ja.30	0.12½
Nipissing	N. Y. Curb	6½	5⅜	6	De.31, Ja.2, Q	0.15
Park Utah Cons	New York			9⅜	De. 15, Ja. 2	0.15
Temiskaming	Toronto	*13½	*12	*13	Jan., 1920	0.40
SILVER-LEAD						
Ahumada	New York	9¼	9	9⅛	De.15,Ja.2, X	0.25
Alta Merger	Salt Lake	†5½	†3½			
Bingham Mines	Boston	54½	53	54½	De.19, De.20 Q	1.00
Cardiff M. & M.	Salt Lake	*60	*59	*59	De.16, No.18	0.10
Chief Consol	Salt Lake	3.85	3.80	3.80	Oc. 10, No. 1	0.10
Emma Silver	Salt Lake	†2	†1			
Erupcion	Boston Curb	2⅛	1 15/16	2	De.15, Ja.2, X	0.10
Federal M. & S.	New York	77	74½	77	No.25, De.15 Q	1.75
Federal M. & S., pfd.	New York	98½	91	96½	Au.25, Se.15	1.75
Hecla Mining	N. Y. Curb	18	17⅞	17⅞	No.15, De.15 Q	0.50
Iron King Mining	Salt Lake	*44	*43	*44		
Keystone Mining	Salt Lake	*61	*58	*58	Au.12, Au.26	0.07½
Lucky Jim	Spokane	*13	*12⅝	*12⅞		
Mammoth Mining	Salt Lake	2.92½	2.80	2.90	De. 16, De. 23	0.10
Marsh Mines	Spokane	*7⅛	*7⅛	*7⅜	Se.15, Oc.1	0.15
Park Utah	Salt Lake	7.60	7.05	7.10	Se.15, Oc.1	0.15
Silver King Coal	Salt Lake	10.50	10.00	10.00	De.15, Ja.2, QX	0.35
Silversmith	Spokane	*34	*33	*33¾	Oc.1, Oc.10	0.01
Tamarack-Custer	Spokane	*36	*35	*35	Sept., 1924	0.25
Tintic Standard	Salt Lake	14.50	13.87½	14.00	De.16, Ja.2,QX	0.50
Utah-Apex	Boston	7	6¼	6¼	Oc.3, Oc.15, Q	0.35
Western Utah Copper	N. Y. Curb			*10		
IRON						
Bethlehem Steel	New York	50¼	48¼	49¼	July, 1924	1.25
Colorado Fuel & Iron	New York	39⅝	37⅝	38	May, 1921	0.75
Gt. North'n Iron Ore	New York	25⅞	25¼	25⅜	De. 4, De. 28,	0.75
Inland Steel	New York	44	43¼	43½	No.13, De.1 Q	0.62½
Mesabi Iron	N. Y. Curb	1⅞	1½	1¾		
Replogle Steel	New York	15⅞	15½	15⅝		
Republic I. & S.	New York	61⅞	57⅞	60½	May, 1921	1.50
Republic I. & S. pfd.	New York	94	93⅜	94	De.15, Ja.2, Q	1.75
Sloss-Sheffield S. & I.	New York	143½	134	137½	De.10, De.21 Q	1.50
Sloss-Shef. S.&I. pfd.	New York	104	103	104	De.21, Ja.2, Q	1.75
U. S. Steel	New York	137⅜	133⅛	135⅛	No.28, De.30 XQ	1.75
U. S. Steel pfd	New York	126	125¼	126	No. 3, No. 28, Q	1.75
Virginia I. C. & C.	New York	46	46	46	Jan., 1924	1.50
Virginia I.C.&C.pfd	New York			77	De.15, Ja.2,	2.50
VANADIUM						
Vanadium Corp.	New York	32⅜	31¼	32¾	No.2, No.16 Q	0.50
ASBESTOS						
Asbestos Corp	Montreal	94	94	94	Se.30, Oc.15 Q	1.50
Asbestos Corp., pfd.	Montreal	115	114¾	115	Se.30, Oc.15, Q	1.50
SULPHUR						
Freeport Texas	New York	21⅜	20	21	Nov., 1919	1.00
Texas Gulf	New York	118⅛	114½	118	De.1, De.15,QX	2.75
DIAMONDS						
De Beers Consol	New York	27⅛	27⅛	27¼	Jy.27, Au.30	0.97
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	6	5⅜	6		
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	54	52⅜	53⅜	No. 20, De. 1, Q	1.00
Amer. Metal pfd	New York	117¼	117	117	No. 21, De. 1, Q	1.75
Amer. Sm. & Ref.	New York	135½	122	134	Oc.16, No.2, Q	1.75
Amer. Sm.&Ref.pfd.	New York	113½	112⅜	113⅜	No.6, De.1, Q	1.75
Consol. M. & S.	N. Y. Curb	152	151⅞	152	Jn.30, Jy.15	0.75
Federated Metals	N. Y. Curb			24½		
Newmont Mining	N. Y. Curb	45¾	45¼	45⅝	Oc.1, Oc.15	0.60
Southwest Metals	N. Y. Curb			2⅜		
U. S. Sm. R. & M.	New York	47	45½	47	Oc.7, Oc.15, Q	0.75
U.S. Sm. R.&M.pfd.	New York	49⅛	48½	49⅛	Oc.7, Oc.15, Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange and George H. Watson & Co.; Colorado Springs, Colorado Springs Stock Exchange.

LONDON QUOTATIONS, WEEK ENDED DEC. 5, 1925

	High	Low	Last	Date	Per Cent
Aramayo Mines (25 frs.)	82/6	80/—	82/6	Nov. 1925	5(c)
British Platinum	7/6	6/3	7/6	Feb. 1925	2½
Burma Corpn. (10 rupees)	19/—	18/1½	18/6	Aug. 1925	6 annas
Bwana M'Kubwa	7/1½	6/9	6/10½		
Camp Bird	6/4½	5/3	6/—		
El Oro	5/10½	5/4½	5/9	Nov. 1924	2½*
Esperanza	1/—	—/9	1/—		
Frontino & Bolivia	9/1½	7/6	7/6	Jan. 1926	1½
Mexican Corporation	22/3	20/3	21/—	Dec. 17	2/6
Mexican Mines of El Oro	37/6	36/3	37/6	Dec. 1925	12½*
Nechi (pref. 10s.)	2/6	2/—	2/—	1921–22	25
Oroville Dredging	4/—	3/3	4/—	Dec. 1923	3½
Ouro Preto	2/6	2/—	2/6	May 1925	2½
St. John del Rey	11/9	10/3	11/—	June 1925	6¼
San Francisco Mines	30/—	28/7½	29/—	June 1925	15
Santa Gertrudis	21/10½	20/6	20/9	July 1920	5
Selukwe (2s. 6d.)	13/10½	11/3	13/3	April 1917	6⅜
S. American Copper	6/7½	5/9	5/9	Nov. 1917	75
Tanganyika	48/9	46/3	47/6	Sept. 1925	5
Tomboy	4/7½	4/6	4/6	Sept. 1925	5
Union Minière du Haut-Katanga (Brussels) 100 Fr.	6.550	6.500	6.550	July 1925	150(b)

* Free of British income tax. (b) Belgian francs. (c) Swiss francs.